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DRAFT
Technical Memorandum

LTCP Optimization Selected Alternative

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Buffalo Sewer Authority
Wet Weather Operational Optimization

Project Number 299

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List of Abbreviations

BSA	Buffalo Sewer Authority
CEJST	Climate and Economic Justice Screening Tool
CEQ	Council on Environmental Quality
CCI	Construction Cost Index
CSO	Combined Sewer Overflow
EJ	Environmental Justice
ENR	Engineering News Record
GCCS	Globally Coordinated Control Strategy
GI	Green Infrastructure
ILS	In-line Storage
LTCP	Long Term Control Plan
MBO	Market Based Optimization
NYSDEC	New York State Department of Environmental Conservation
OLS	Off-line Storage
OPCC	Opinions of Probable Construction Cost
RTC	Real-Time Control
SPP	Sewer Patrol Point
SWMM	Stormwater Management Model
TBM	Tunnel Boring Machine
USEPA	United States Environmental Protection Agency

Introduction

The most recent revision of Buffalo Sewer Authority's (BSA's) Long Term Control Plan (LTCP) was completed and approved in 2014 by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA). The approved document outlined a multi-year plan for implementing projects to reduce overflows in the BSA sewer collection system to target levels. Potential projects included a mix of in-line storage (ILS), off-line storage (OLS), real time control (RTC), and green infrastructure (GI). The collection system hydraulic model used in the LTCP was updated after completion of the first phase of LTCP projects. Simulations from the updated LTCP model suggest that some projects envisioned in the LTCP are no longer feasible and that other planned projects can be further optimized to meet targets. BSA has contracted the Xylem team to devise an updated plan of cost-effective projects that is anticipated to meet LTCP goals.

The project team has worked collaboratively with BSA to compile a revised list of potential projects to be considered. The list included both new projects and those projects from the 2014 LTCP preferred alternative which have not since been ruled infeasible or unnecessary. An optimization process was then leveraged to evaluate the impacts of implementing different variations and combinations of these projects with the goal of minimizing both CSO activations and construction costs. The project team also optimized the distributed control scheme to find the optimal combination of control set points that maximize the system's conveyance and storage capacity. The result of these activities is a new set of recommended projects (the Selected Alternative) for achieving LTCP compliance. This process and the Selected Alternative are further described herein.

Objective

This technical memorandum has two main objectives. First, it documents an updated understanding of the projects included in the recommended alternative from the 2014 LTCP, referred to as baseline projects. A summary is provided of further information on the baseline projects gathered since 2014. This includes updated modeling results, discussion of construction feasibility, and updated cost estimates. This summary demonstrates that implementation of the baseline projects would be more challenging and costly than originally anticipated, and furthermore would not achieve the required level of control.

Second, this memorandum provides an overview of the optimization process carried out by the project team in order to select a revised set of projects for achieving LTCP compliance. The resulting set of projects (the Selected Alternative) is presented herein. The results from a Typical Year model simulation are summarized to demonstrate performance of the Selected Alternative with respect to LTCP compliance. A description and estimated cost are provided for each project in the Selected Alternative.

Updated Understanding of Baseline Projects

2014 LTCP Projects Updated Model Results

Over the past 5 years, BSA's collection system model has been calibrated and updated to reflect current system conditions. To determine the ability of projects to mitigate SPP activations, the newly calibrated PC-SWMM model was populated with the LTCP projects implemented to date,

as well as the remaining planned LTCP projects. The objective was to determine if the 2014 LTCP plan would still achieve compliance. It was expected that the use of the new calibrated PC-SWMM model would result in more refined results than the XP-SWMM model used in the 2014 LTCP because:

- The new PC-SWMM model incorporated additional nodes and links not incorporated in the original XP-SWMM model.
- The recent calibration utilized flow data that should reflect more current conditions.
- More subbasins were defined, allowing for more representative parameters for a given area.

The calibrated PC-SWMM model with the 2014 LTCP plan projects is referred to in this memo as the "LTCP baseline projects model" or the "baseline plan".

Compliance is defined by the number of activations allowed in the typical year for the SPPs receiving waterbody (Table 1). The following sections describe the performance of various CSOs and SPPs under the typical year baseline projects model simulation. This allows for a baseline to be set moving forward with a focus on areas not expected to meet their targeted activations. The projects included in the LTCP Baseline Projects model scenario and the remaining out of compliance SPP activation volumes are provided in Attachment A. The largest out of compliance activation is referred to as the "X+1" activation, with X representing the maximum number of activations in a typical year. Activation events are sorted from largest to smallest volume to determine which event is the "X+1" event.

Table 1. Target number of activations in the Typical Year by receiving waterbody

Receiving Waterbody	Target Number of Activations in Typical Year
Black Rock Canal	0-4
Buffalo River	0-6
Cazenovia Creek- B	0
Cazenovia Creek- C	0-6
Erie Basin	0-2
Niagara River	0-9
Scajaquada Creek	0-4

Hertel District

The Hertel District has six CSOs that discharge to either the Niagara River, Black Rock Canal, or Scajaquada Creek. Per the results using typical year rainfall, the following CSO in the Hertel District is still projected to exceed its targeted activations if the remaining projects as defined in the LTCP are implemented:

- CSO-055 (SPP001) – Niagara River. The updated LTCP model estimates 31 activations in the typical year with 14 projected when the baseline projects are implemented. The target number of activations is nine.

Scajaquada District

The Scajaquada District has 12 CSOs that discharge to either Black Rock Canal or Scajaquada Creek. Per the results using typical year rainfall, the following CSOs in the Scajaquada District are still projected to exceed their targeted activations if the remaining projects as defined in the baseline plan are implemented:

- CSO-053 (SPPs 229A, 175, 165B, 340, 338, 337, 339, and 336B) - It is expected that the eight SPPs identified will exceed the target of four activations at the end of the LTCP period. The model currently estimates between five and 37 activations at each of these SPPs in the typical year. At the end of the LTCP period, between five and 26 activations are projected at these SPPs. Most notable is the increase in activations projected at SPP340 because of a recently discovered cross connection between the SPP339 and SPP340 basins. However, significant reductions in activations are projected to be achieved at SPPs 337, 339, and 336B, if the remaining LTCP projects are implemented as sized in the baseline plan. The remaining 30 SPPs associated with this CSO have been determined to already meet compliance in the baseline plan model.
- CSO-004 (SPP013) - The model currently estimates five activations in the typical year. Six activations are projected at the end of the baseline plan period due to the impact of the SPP 331 flow redirection project as envisioned in the baseline plan.
- CSO-006 (SPPs 179, 180, 331) - Seven activations are still projected for SPP180 and 15 for SPP179 at the end of the baseline plan period. However, while flow redirection, supplemental capacity, and orifice modifications were proposed in the baseline plan to bring SPP331 into compliance with targeted activations, other projects are likely to be considered as part of the optimization process as flow redirection in this area has more recently been removed from consideration.

South Central District

This district is by far the largest district with 34 CSOs, with discharges to Buffalo River, Niagara River, Black Rock Canal, Erie Basin, and Cazenovia Creek. Per the baseline results using typical year rainfall, the following CSOs in the South Central District are still projected to exceed their targeted activations if the remaining projects as defined in the baseline plan are implemented:

- CSO-026 (Smith St. ILS) - The model results show that the targeted number of activations of six to the Buffalo River will almost be achieved with seven activations projected at the completion of the baseline plan. It is also noted that these activations are not projected to occur at the individual SPPs but are consolidated at the Smith Street ILS structure.
- CSO-017 (SPPs 059, 056, 058, 065, 128, 067, 055, 326) - While significant reductions in activations are estimated (from the projected maximum activations of 20 during the typical year to 10 - 12 activations at the end of the baseline plan), it is expected that the target of six activations will not be met. Similar to the consolidation of overflows for CSO-026 at the Smith Street RTC, overflows for SPPs 056, 058, 067 and 055 will be consolidated at the Mill Race RTC structure, currently in design.
- CSO-027 (SPP097) - Eleven activations are projected at this SPP and CSO upon the completion of the baseline plan, while the target number of activations is six.
- CSO-029 (SPP126) - Twelve activations are projected at this location upon the completion of the baseline plan, while the target is six.
- CSO-037 (SPP122) - Nine activations are projected upon the completion of the baseline plan, while the target number for Cazenovia Creek- C is six.
- CSO-033 (SPP104) - Fifteen activations are projected upon the completion of the baseline plan, with a targeted number of six.

Summary

Four projects originally proposed in the baseline plan were deemed to no longer be necessary when running the updated PC-SWMM model using the typical year rainfall because their downstream SPPs were in compliance:

- CSO-052 Off-Line Storage
- SPP019 Underflow Upsizing
- SPP330 Underflow Upsizing
- SPP336A Underflow Upsizing

The LTCP optimization efforts will focus on the ten CSOs mentioned above and the optimization of project configuration and size. Remaining projects proposed in the baseline plan will be optimized, and new projects will be identified to meet the target activations at those CSOs not projected to be compliance. As a result, it is expected that some of the projects identified in the baseline plan that have not been implemented will be modified from how they were originally proposed, based on the results of the optimization work.

Baseline Projects Feasibility Constraints

The baseline plan projects generally fall under two categories: off-line storage and storage tunnels. Both overflow control strategies are effective but are difficult to implement in the City of Buffalo. Key factors that need to be considered during the planning phase of each project include land acquisition, environmental justice, operations costs, and depth to bedrock.

Storage structures require a significant footprint to hold millions of gallons of combined wastewater. These structures can be centralized so that a single point collects the target volume, decentralized with many smaller storage facilities, or a combination of both. The City of Buffalo is fully developed, and the public right-of-way is crowded with existing utilities. To build these structures and enable BSA to operate them in perpetuity, permanent easements would need to be acquired or land would need to be purchased. Alternatively, these structures can be constructed in existing public lands, such as parks.

Land acquisition for structures also requires BSA to be cognizant of environmental justice within the city. Much of the City of Buffalo, particularly the East Buffalo and the West Side neighborhoods, have been historically underserved and have large minority populations. Past public projects, like construction of the Kensington Expressway, divided neighborhoods and displaced families. Implementation of CSO control projects must be aware of these past injustices and find a way to meet the goals of the LTCP while improving the lives of residents. Environmental Justice was not a factor in site selection during the baseline plan conceptualization. Some areas like the Scajaquada district have baseline projects that need to be re-sited to minimize adverse effects on quality-of-life.

Another constraint that needs to be considered is operations costs. Off-line storage tanks have traditionally been installed so that the hydraulic grade line in the tank is lower than the target overflow HGL and pumped back to the system or pumped to an elevated tank for release by gravity at a later time. Both configurations require a significant amount of energy and manpower to operate and clean the equipment installed in these structures. Selected storage and tunnel configurations should attempt to minimize operations costs by minimizing the use of mechanical equipment. Selected off-line storage sites should utilize existing grade changes within the system to fill and/or drain by gravity to the maximum extent possible. Structure hydraulics should also be optimized for self-cleaning.

Bedrock is a significant constraint when configuring any underground structures. Most of the City was constructed on Onondaga Limestone, which separates shale formations that formed north and south of the City. It is a hard bedrock that forms outcrops along Lake Erie and in Ontario and is shallow throughout most of the city. Record drawings from previous sewer projects show that bedrock was a concern during construction of the interceptors and tunnels. New storage structures will require considerable effort to build within the rock. Planning for the work should consider rock removal methods and their relation to construction costs, construction timelines, and residents' quality of life.

Proper project planning is required to ensure that these constraints are addressed. The intent of re-evaluating these projects is to determine which ones are feasible as originally intended and to modify projects with identified constraints that prevent implementation as originally intended. This could help minimize the cost burden on rate payers while maximizing residents' quality of life in relation to their construction and subsequent operation and maintenance. Baseline project implementation will select sites that address these concerns as best as practical while ensuring that stakeholders are included in planning so that their concerns are addressed.

Baseline Projects Updated Cost Estimates

Planning level cost estimates for the LTCP Preferred Alternative projects were first prepared in 2011. To establish updated baseline costs for the pending optimization work, the original cost curves, as well as the itemized cost estimates specific to each project, were updated to reflect pricing through the end of 2022. The procedures used to update both the cost curves and project specific estimates are described below.

Four individual cost curves were originally developed for the baseline plan: storage, high-rate treatment, conveyance piping, and sewer separation. To update these cost curves, the Engineering News Record (ENR) Cost Construction Index (CCI) was utilized. The ratio between the 2022 and 2011 ENR CCI values was applied to the 2011 cost curves, and these curves were then compared to known costs from previous BSA projects. The 20-city average CCI was used except when city-specific data had been the basis of the 2011 values. The 20-city average was selected for two reasons: 1) to obtain consistency, since these indices were used in the previous versions of the spreadsheets, and 2) because ENR suggests using the 20-city average when city-specific data is not available. It should also be noted that based on a review of the BSA's construction projects to date, including real time control structures and underflow projects, site-specific constraints (such as shallow bedrock) had a significant effect on construction costs, which makes it difficult to fit this data to a standard cost versus size-type curve.

The itemized, project-specific construction cost estimates were updated in magnitude as well as scope. A first set of cost revisions was made using NYSDOT pricing, both statewide and regional. When these prices were not available for a specific line item, the increase in ENR CCI values was applied to the 2011 costs in the same manner as was described above for the cost curves. For pumps in particular, a manufacturer's representative was able to provide current budgetary pricing estimates for likely design points. A second revision was then made to incorporate additional line items not represented in the 2011 estimate, but likely necessary based on BSA's experience implementing other LTCP projects. Prices for these items were developed from the Schedule of Values for representative LTCP projects and engineering judgment. In addition, high-level site-specific layouts were developed for each project and used to evaluate potential site constraints that could affect construction pricing. The updated cost estimates can be found in Attachment B. The estimated cost for the Preferred Alternative projects was $258,600,000 in the 2014 LTCP.

With the revisions described, the total remaining Preferred Alternative project cost is now estimated to be $702,585,744.

A separate Financial Capability Assessment (FCA) Update, prepared by Greeley and Hansen on behalf of BSA and dated December 31, 2020, showed that the BSA continues to face a heavy financial burden with the current baseline plan implementation schedule. Baseline plan costs were escalated in the FCA effort using ENR CCI values; however, this work was done based on 2019 dollars, prior to the effects of the COVID-19 pandemic becoming evident on the construction industry, and the costs for the baseline projects presented in Figure 3-20 of the FCA are significantly less than the current estimates developed.

Optimization Approach

Considering the costs, feasibility constraints, and anticipated non-compliance of the 2014 LTCP Preferred Alternative, an iterative optimization process was conducted to identify new opportunities to improve utilization of existing system capacity and add conveyance and storage capacity where needed most to address SPP activations.

Globally Coordinated Control Strategy

Before beginning the optimization process for new projects, a globally coordinated control strategy (GCCS) was developed for existing and planned RTC sites. This strategy ensures that the RTC sites would work together to prevent overflows and reduce peak flows regardless of local conditions at an individual site. Five of the eight operational RTC sites only consider local conditions to decide when to begin and end storage. The GCCS would involve adding a new Auto-Remote mode to these sites to look at remote monitoring locations and/or other RTC sites to determine when storage is needed to prevent overflows.

For example, rather than only looking at its own upstream level to determine when to enter wet weather mode, North Bailey RTC can look at its downstream SPP level as well as the available capacity at the WWTP to determine the optimal time to begin storage. Smith St. and Mill Race RTCs will compete for capacity in the South Interceptor. Therefore, a Market-Based Optimization (MBO) control method can be implemented to balance the risk for overflow at each structure with the available conveyance capacity in the interceptor. The MBO method is a type of GCCS and is implemented whenever two or more control sites want to use the same downstream capacity. This capacity is dynamically allocated to the control sites based on which sites are at the greatest risk of overflow at that time. With this approach, the downstream capacity is always maximized while minimizing risk upstream.

This is a cost-effective way to improve water quality with the infrastructure that BSA already has in their collection system. The GCCS will continue to be evaluated as projects are implemented to optimize system performance in real life conditions. While benefit is shown in the typical year uniform rainfall SWMM simulation, the GCCS is expected to significantly increase storage utilization in distributed rainfall scenarios due to the larger variance in local conditions.

System Evaluation

The optimization process began with a system evaluation, which included identifying projects to be considered. This was a collaborative effort between the BSA and the project team, and ideas were added or removed from the project list based on a variety of factors including:

- Property ownership
- Underground contamination concerns
- Ability to utilize gravity flow rather than pumping when possible
- Impact on SPPs with low target activations and high overflow volume in the LTCP baseline
- Potential coordination with other construction projects

The full list of 77 projects considered during the optimization, including ILS, OLS, green infrastructure, sewer separation, and SPP modification projects, can be found in Attachment C. Each project was initially identified as a general concept, with sizing and configuration specifics modified through the optimization process. Projects from the baseline plan were considered as part of this process, with those projects determined to be infeasible removed from the list.

The updated cost curves (as described under Baseline Projects Updated Cost Estimates) were used to estimate the effect of adjusting project sizes on the total cost. For projects without cost curves, such as RTC projects, the average BSA implementation cost for that type of project was used. These cost curves did not account for site specific constraints such as depth to bedrock, which is included in the detailed cost estimate for the Selected Alternative.

Optimization

From there, the project team began the process of selecting an optimal set of projects to achieve LTCP compliance while minimizing cost. An optimization of this scale becomes complex due to the sheer number of variables under consideration. The project team leveraged several advanced computing tools and techniques, including the use of cloud computing. The overall process was iterative but can be grouped into the three main steps described below.

Optimization Round 1

The objective of Round 1 was to narrow down the set of project alternatives per SPP. Component models were developed for out of compliance SPPs that included branches upstream of the SPP of interest and the critical interceptors downstream of the SPP. Test events were established for each component model as a proxy for the typical year. These events varied according to the SPP's activations in the baseline model typical year. The activations were ordered from largest to smallest overflow volume, and the following events were used for testing, where X represents the number of target activations:

- X-1 event – second smallest volume in compliance activation
- X event – smallest volume in compliance activation
- X+1 event – largest volume out of compliance activation
- X+2 event – second largest volume out of compliance activation

Projects were added to and removed from the component models to determine which projects were most cost effective for removing out-of-compliance activations. Projects were removed from consideration after Round 1 if they did not have a significant impact on the number of activations.

Optimization Round 2

For Round 2, the scope of the optimization expanded to the full system with the objective of achieving compliance at all SPPs. Instead of component models, a skeletonized, full system model was used. The skeletonized model replaced some branches of the model that did not contain projects under consideration with inflow timeseries at new boundary junctions. A new set of test events was selected to include activations at all SPPs that were out of compliance in the baseline. Along with the model adjustments, using test events allowed more project implementation scenarios to be evaluated efficiently. These scenarios included different combinations of the projects to be implemented, structure sizing, and real-time control timing. The optimization parameters included:

- Binary parameters to turn projects “on” or “off” in the model
- OLS size parameters to adjust storage tank footprint/total volume
- OLS inlet weir height parameters to shift the timing of storage
- Control curve parameters to adjust gate settings
- ILS/Conveyance/Tunnel diameter and length parameters
- SPP Modification underflow diameter and weir height parameters

The results of the Round 2 optimization informed what size ranges and configurations would be included in the next round.

Optimization Round 3

The objective of Round 3 was to minimize the project cost while still achieving compliance. The refined project configurations from Round 2 were applied to the skeletonized, full system model. The upper and lower bounds for the optimization parameters were adjusted based on the outcomes of Round 2, and cost was included in the multi-objective optimization along with the volume of untreated flow and the number of out of compliance activations for the optimization test event group.

The project set from Round 3 that minimized the number of out of compliance activations in the skeletonized model test events for the lowest cost was incorporated into the full model for the official Typical Year simulation. The first simulation showed 8 SPPs still out of compliance in the typical year (v2.1.0-ltcp). To achieve compliance and generate reasonable detailed cost estimates, the project configurations were updated. The resulting set of projects is the Selected Alternative. Project details and typical year results for the Selected Alternative are included in the following sections.

Overview of Projects in Selected Alternative

The project team collaborated with BSA to identify 77 projects for consideration during the LTCP optimization process. A tagging system was developed to identify the project impact area as well as the alternatives that could be combined or substituted for each other. For example, project CSO014_1.1, impacting CSO-014, is in the first alternative group, and is the first alternative within that group. All 77 projects considered are documented in Attachment C.

Of these 77 projects, 51 projects were ultimately included in the Selected Alternative. A figure showing these projects is included in Attachment D. High-level descriptions for the conceptual

project designs are provided below. More detailed figures and design considerations for the OLS projects are also included in Attachment D.

Systemwide Impact Projects

The following Selected Alternative projects may impact multiple CSOs by increasing available conveyance and storage capacity in the collection system. Additional projects with systemwide impacts considered during the optimization process included pump station RTC, different tunnel locations, and off-line storage.

Northern Relief Tunnel (System_1)

PRIMARY CSO IMPACTED: 011, 012, 055
PROJECT TYPE: Tunnel
2014 LTCP PROJECT: Yes
The Northern Relief Tunnel is designed to create more conveyance capacity to the WWTP, supplement capacity in the North and South Interceptors, and increase the ability of the system to store wet-weather flows. It is anticipated that the tunnel will have an inside diameter of 12-feet based on the most recent system simulations. This is subject to change if alternate RTC sites are constructed as the LTCP evolves. This tunnel system is anticipated to have three parts, North of Scajaquada Creek, South of Scajaquada Creek, and the Southern Relief Tunnel.

North of Scajaquada Creek is anticipated to be constructed as a potential replacement for the Military Road OLS project. The anticipated route for the tunnel will be to start at Tonawanda Street and head south. The launch shaft will also be needed for open cut connections to the large parallel sewers that connect to SPP 1 from Hertel Avenue. Provisions will need to be installed in the drop shaft to dissipate energy from high flows and reduce entrained air that might be generated from a waterfall.

This section of the tunnel is currently under development as multiple alignment options are being investigated. The alignment is required to pick up flow from the north, near Arthur St. or Hertel Ave., and extend to the southern end towards Breckenridge St. at the Breckenridge Siphons. These siphons would then connect the new system to the Bird Island Treatment Facility. The entire length of tunnel is estimated to be approximately 2.3 miles and would be constructed in multiple sections using a Tunnel Boring Machine (TBM).

Based on the alignment optioneering, a probable alignment was selected to best connect the northern and southern tie-in locations. The first Launch Shaft compound is feasible at the corner of Arthur and Tonawanda St., with the tunnelling drive extending approximately 0.6 miles to an Exit Shaft location near Arthur St. and Tonawanda St. This Exit Shaft compound will serve as the Exit Shaft for a second tunnel drive, which will begin at the second planned Launch Shaft, located at the Buffalo Impound Lot at Dart St. and Letchworth St. This central tunnel drive is approximately 0.5 miles and will need to be planned carefully to access the required lands for the shaft compound, and to travel below the existing Scajaquada Expressway, below the Scajaquada creek, and below the existing train line, likely owned by CSX or Amtrak. The final tunnel drive will travel from the central Launch Shaft in a south-west direction and navigate a curved alignment to tunnel below Niagara St. to the southern connection point at the siphon tie-in at Niagara St. and Breckenridge St. This will be the longest tunnel drive at approximately 1.2 miles and will require careful planning to navigate the existing supports of the Scajaquada Expressway, existing utilities,

and mixed face ground conditions. This alignment is not finalized and has been considered at this stage of the design based on the overall feasibility and the available lands for shaft compounds. The Southern Relief Tunnel is anticipated to start at Albany Street and connect to the proposed junction chamber near the Breckenridge Siphons. The general route for this sewer will be to flow North on the western Side of Niagara Street. The current Swan Trunk connection and associated sewers will need to be reconfigured at this area to relieve the South Interceptor and convey flow to the WWTP. The approximate length of this section is 700 feet.

The anticipated tunnel operation is to flow by gravity into the siphons. To operate this way, the tunnel invert will need to be higher than the existing Breckenridge Siphons. This places the tunnel in a position where the northern tunnel will be installed below the water table and mixed rock/soft material conditions. This type of construction will likely require use of soft ground TBM, which is an appropriate tool for mixed conditions but is ideal for soft, wet ground. It may be possible to install the entire tunnel below bedrock if the tunnel can be dewatered by pumping. Next steps for tunnel design include bedrock and soils characterization along anticipated routes, an engineering evaluation to optimize the tunnel alignment, and acquisition of easements and property to construct access shafts.

Schiller Park OLS (System_2)

PRIMARY CSO IMPACTED: 012, 055
PROJECT TYPE: OLS
2014 LTCP PROJECT: No
The Schiller Park OLS project is an offline storage project that would divert inflows from Cheektowaga to an 8.00 MG storage facility during wet weather until the BSA collection system has capacity to receive and treat it. This project would help buffer peak flows to the Bird Island Treatment Facility and reduce overflows at SPPs along the North and South Interceptor, including SPP001 and SPP024. The OLS is currently configured as a gravity-driven storage with dynamically controlled inlet and outlet gates.

SPP339 Modification (System_2_3)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP339 is located north of the intersection of Kerns Avenue and Texas Street. For this project, SPP339 would be modified by increasing the diameter of the underflow pipe to 48”, and by raising the elevation of the overflow weir to 52.71 ft (City datum). These modifications would reduce CSO-053 overflows, and would benefit from the implementation of Schiller Park OLS or Sidney OLS to free up capacity in the Scajaquada Tunnel

SPP340 Modification (System_2_4)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP340 is located north of the intersection of Kerns Avenue and Hagen Street. For this project, SPP340 would be modified by increasing the diameter of the underflow orifice to 24”. A flap gate would also be applied to prevent backflow from the Scajaquada Drain. This modification would

reduce CSO-053 overflows, and would benefit from the implementation of Schiller Park OLS or Sidney OLS to free up capacity in the Scajaquada Tunnel

CSO-006 Projects

CSO-006 is a Scajaquada District CSO located at the end of the Delavan Drain on the Black Rock Canal, which is a high priority waterbody for water quality improvements (four target activations in the typical year). One additional RTC project was considered in this area but was not included in the Selected Alternative because the other projects were able to achieve compliance for a lower cost.

Gates Circle RTC (CSO006_2)

PRIMARY CSO IMPACTED: 006
PROJECT TYPE: RTC
2014 LTCP PROJECT: No
The Gates Circle RTC project would divert flow from the Bird Trunk to the Scajaquada Tunnel via a controlled connection at SPP332. The site would relieve the Bird Trunk and Black Rock Canal SPPs by sending more flow to the Scajaquada Tunnel when it has available capacity. The gate would close when the Scajaquada Tunnel does not have capacity, sending more flow to the Bird Trunk. This project includes adding instrumentation at the Niagara Metering Station (SPP330) to inform the gate control.

Delavan Drain RTC (CSO006_3)

PRIMARY CSO IMPACTED: 006
PROJECT TYPE: RTC
2014 LTCP PROJECT: No
There is an existing sluice gate near the end of the Delavan Drain that connects the Delavan Drain to the North Interceptor at the intersection of West Delavan Ave. and Niagara St. The sluice gate is currently kept closed all the time. The Delavan Drain RTC project converts this connection to a dynamically controlled gate that opens when the North Interceptor has available capacity and closes when there is no risk for overflow at CSO-006.

This project would require adjustments to the connectivity between the Delavan Drain and the Scajaquada Drain, which sends a large amount of creek flow to the Delavan Drain during most storm events. In the Selected Alternative model, the SPP170A structure was modified to only send flow from the Scajaquada Drain to the Delavan Drain in extreme storm events to prevent flooding.

Since the Delavan Drain RTC project is downstream of the CSO-006 SPPs, it would provide another opportunity to capture out-of-compliance activations before they become CSO-006 overflows. This project would also benefit from the additional conveyance capacity created by the Northern Relief Tunnel project.

20% GI Implementation (CSO006_5)

PRIMARY CSO IMPACTED: 006
PROJECT TYPE: GI
2014 LTCP PROJECT: Yes
Green infrastructure projects would be constructed within the basin sufficient to control runoff from 20% of the impervious area within the basin (52.5 acres managed). The exact list of projects to be implemented would be determined during the design phase, but would likely consist of some combination of the following project types, as originally defined in the BSA's Green Infrastructure Implementation Plan:

- Street permeable pavement
- Parking lot permeable pavement
- Rain Gardens
- Bioswales
- Downspout disconnections

For this evaluation, street permeable pavement was applied as the representative GI project.

CSO-010 Projects

CSO-010 is a Scajaquada District CSO that overflows to the Black Rock Canal (target of four activations) near the siphon to the Bird Island Treatment Facility at Breckenridge St. Only one project was considered in this area.

Breckenridge Niagara RTC (CSO010_1)

PRIMARY CSO IMPACTED: 010
PROJECT TYPE: Diversion/RTC
2014 LTCP PROJECT: No
The Breckenridge Niagara RTC project is being proposed as an alternative to the CSO-061, 008, and 010 underflow upsizing project in the LTCP baseline plan. Since the target activations are already met in the baseline model at CSO-008 and CSO-061, the project only needs to address activations at CSO-010. The site would be configured similar to the Smith St. and Mill Race RTC projects, with a static weir in the 36" diameter pipe upstream of SPP021 diverting flow to a new controlled connection to the North Interceptor. This project also has the potential to reduce overflows at CSO-011 (SPP024) and CSO-055 (SPP001).

CSO-011 Projects

CSO-011 discharges to the Niagara River, with a target of nine activations in the typical year. Both projects considered for this basin were included in the Selected Alternative.

20% GI Implementation (CSO011_1.1)

PRIMARY CSO IMPACTED: 011
PROJECT TYPE: GI
2014 LTCP PROJECT: Yes
Green infrastructure projects would be constructed within the basin sufficient to control runoff from 20% of the impervious area within the basin (19.9 acres managed). See CSO006_5 for details.

SPP024 Modification (CSO011_1.2)

PRIMARY CSO IMPACTED: 011
PROJECT TYPE: SPP
2014 LTCP PROJECT: Yes
For this project, SPP024 (CSO-011) would be modified by enlarging the underflow opening to 4.8 ft, which would send more flow to South Interceptor and reduce overflows at CSO-011. This project would benefit from the additional downstream conveyance capacity provided by the Northern Relief Tunnel and OLS projects in the South Central District.

CSO-012 Projects

CSO-012 is a Scajaquada District CSO that discharges to the Black Rock Canal. Seven projects in this area were considered during the optimization to meet the target of four activations in the typical year. SPP modifications were selected as the most cost-effective solution.

SPP023 Modification (CSO012_1.2)

PRIMARY CSO IMPACTED: 012
PROJECT TYPE: SPP
2014 LTCP PROJECT: Yes
For this project, SPP023 (CSO-012, Albany St. and Niagara St.) would be modified by enlarging the underflow opening to 5 ft by 5 ft and by raising the overflow weir to 1.55 ft (City datum). These modifications would send more flow to the South Interceptor and reduce overflows at CSO-012. This project would benefit from the additional downstream conveyance capacity provided by the Northern Relief Tunnel and OLS projects in the South Central District.

SPP296 Modification (CSO012_2.1)

PRIMARY CSO IMPACTED: 012
PROJECT TYPE: SPP
2014 LTCP PROJECT: Yes
For this project, SPP296 (CSO-012, Albany St. and Niagara St.) would be modified by enlarging the underflow opening to 5 ft by 5 ft and by raising the overflow weir to 1.55 ft (City datum). These modifications would send more flow to the South Interceptor and reduce overflows at CSO-012. This project would be implemented after or in parallel with the SPP023 modification since it is directly upstream of the SPP023 underflow.

CSO-013 Projects

CSO-013 discharges to the Black Rock Canal at LaSalle Park. Only one project was considered in this area.

SPP304 Modification (CSO013_1)

PRIMARY CSO IMPACTED: 013
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
For this project, SPP304 (CSO-013, Virginia St. & Busti Ave.) would be modified by removing the underflow orifice plate, reducing overflows at CSO-013. Since this project sends more flow to the Swan Trunk, it would benefit from the implementation of OLS projects in the South Central District.

CSO-014 Projects

CSO-014 is a South Central District outfall in Erie Basin Marina, which is the Buffalo waterbody with the lowest number of target activations – two in the typical year. Both projects considered in this area were implemented in the Selected Alternative to achieve compliance.

SPP206A&B ILS Optimization/206 A&B RTC (CSO014_1.1)

PRIMARY CSO IMPACTED: 014
PROJECT TYPE: RTC
2014 LTCP PROJECT: No
There is an existing static control ILS project at SPP206A&B that was completed as part of the Swan Trunk Improvements project. The storage relieves the Swan Trunk (reducing overflows at SPP206A&B) and gradually dewaters to the South Interceptor. The proposed RTC project adds a 24” dewatering gate and connection to the South Interceptor. The gate would open to send more flow to the South Interceptor when it has available capacity, and close when it is near full capacity. This would further reduce overflows at SPP206A&B and could provide additional benefit downstream at SPP024 (CSO-011).

Erie Basin Marina OLS (CSO14_1.2)

PRIMARY CSO IMPACTED: 014
PROJECT TYPE: OLS
2014 LTCP PROJECT: Yes
To address CSO-014 overflows, flow from Swan Trunk would be diverted to the proposed Erie Basin Marina OLS. The OLS would consist of a 5.55 MG tank north of the intersection of Trenton Road and Fourth Street. The storage would dewater when there is available capacity in the Swan trunk sewer. The current OLS configuration requires a pump station for dewatering. The inlet for this storage is near SPP206A&B, so it would be beneficial to implement the OLS in conjunction with the SPP206A&B RTC project.

CSO-017 Projects

There are multiple projects planned to prevent overflows at CSO-017 on the Buffalo River (South Central district). The potential impact of these projects would be affected by the performance of the planned Mill Race and Broadway Oak RTC projects as well as the proposed CSO-026 projects. Two OLS projects (Mill Race OLS and 594 Exchange OLS) that were initially considered in this area were not included in the Selected Alternative to reduce costs and consolidate where construction would need to occur.

SPP054 Sewer Separation (CSO017_1.1)

PRIMARY CSO IMPACTED: 017
PROJECT TYPE: Sewer Separation
2014 LTCP PROJECT: No
SPP054 is located near Exchange Street between Hamburg Street and Larkin Street. For this project, the sewer upstream of SPP054 would be converted to a storm sewer and disconnected from the combined system. This would eliminate SPP054 as an SPP.

20% GI Implementation (CSO017_4)

PRIMARY CSO IMPACTED: 017
PROJECT TYPE: GI
2014 LTCP PROJECT: Yes
The CSO-017 basin would have green infrastructure managing 37.5 acres of impervious area. See CSO006_5 description for details.

Bass Alley OLS (CSO017_6)

PRIMARY CSO IMPACTED: 017
PROJECT TYPE: OLS
2014 LTCP PROJECT: No
To address CSO-017 overflows, the Bass Alley OLS would store flow from the Swan Trunk in a 3.60 MG tank in open areas near Seymour St. and Bass Alley. The storage would dewater when there is available capacity in the Swan Trunk. The current configuration of the OLS requires a pump station for dewatering.

SPP326 Modification (CSO017_8)

PRIMARY CSO IMPACTED: 017
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP326 is located south of the intersection of Swan Street and Oak Street. For this project, the SPP326 underflow pipe would be upsized to 36”. This modification would reduce overflows at CSO-017. Since this modification sends more flow to the Swan Trunk, it would benefit from the implementation of the Erie Basin OLS project.

SPP059 Modification (CSO017_9)

PRIMARY CSO IMPACTED: 017
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP059 is located near the intersection of Hamburg Street and Seneca Street. For this project, the SPP059 underflow pipe would be upsized to 24”, and the overflow weir would be raised to 3.25 ft (City datum). These modifications would reduce overflows at CSO-017. Since this project increases flow to the South Interceptor, it would benefit from the implementation of the Clinton St OLS (CSO033_2) project.

SPP051 Modification (CSO017_10)

PRIMARY CSO IMPACTED: 017
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP051 is located south of the intersection of Exchange Street and Chicago Street. For this project, the SPP051 orifice plate would be removed, and the overflow weir would be raised to –1.35 ft (City datum). These modifications would reduce overflows at CSO-017. Similar to the SPP059 modification, it would benefit from the implementation of the Clinton St OLS (CSO033_2) project.

CSO-026 Projects

Overflows at CSO-026 (Buffalo River, South Central district) are currently being addressed by the Smith Perry RTC project and would be further reduced by the Smith Eagle RTC project commissioned in 2022. Two CSO-026 OLS projects and 1 ILS project considered during the optimization were not included in the Selected Alternative to reduce costs.

Collins Park OLS (CSO026_1.3)

PRIMARY CSO IMPACTED: 026
PROJECT TYPE: OLS
2014 LTCP PROJECT: No
The proposed Collins Park OLS project would consist of a 2.56 MG tank at the Collins Park Field between Smith Street and Clifford Street that would serve as an extension of the Smith Street ILS storage. The storage would dewater via gravity when there is available capacity in the downstream sewer and no risk of overflow at the Smith Street ILS facility.

20% GI Implementation (CSO026_4)

PRIMARY CSO IMPACTED: 026
PROJECT TYPE: GI
2014 LTCP PROJECT: Yes
The CSO-026 basin would have green infrastructure managing 125.5 acres of impervious area. See CSO006_5 description for details.

CSO-027 Projects

CSO-027 has one SPP, SPP097, that overflows to the Buffalo River. Overflows in this area are impacted by available capacity in the Swan Trunk and South Interceptor. All the projects considered in this area were implemented in the Selected Alternative.

SPP 317 Modification (CSO027_1)

PRIMARY CSO IMPACTED: 027
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP317 is located north of the intersection of Clinton Street and Fillmore Avenue. For this project, the SPP317 overflow weir would be lowered to 7.25 ft (City datum). Lowering the weir would result in increased flows being directed to the Smith Street ILS facility, while lowering the flows in

the Swan Trunk. The lowered flows in the Swan Trunk results in a reduction in overflows at CSO-027. This project would benefit from the additional downstream storage capacity provided by the Collins Park OLS facility.

Babcock PS Weir Modification (CSO027_2)

PRIMARY CSO IMPACTED: 027
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
Babcock Pump Station operates as an RTC facility to store flows in an upstream 11 ft by 11 ft box culvert during wet weather. The CSO027_2 modification project redirects flow from a 48" sewer to the box culvert instead of the sewer downstream of the pump station. This increases the in-line storage utilization and reduces the flow sent to the Swan Trunk in wet weather.

SPP097 Modification (CSO027_3)

PRIMARY CSO IMPACTED: 027
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP097 is located on Babcock Street, 555 ft north of the Buffalo River. In the currently proposed version of this project, the SPP097 underflow pipe would be upsized to 48 inches. The overflow weir would be raised to 0.82 ft (City datum) with an associated length increase to 100 ft. Upstream diversion alternatives that achieve the same impact as the SPP097 modification are also being considered in this area.

CSO-028 Projects

CSO-028 receives flow from multiple SPPs in the South Central district and overflows to the Buffalo River. Most CSO-028 SPPs are in compliance in the LTCP model. Only one project was considered in this area.

Hopkins & Osage OLS (CSO028_1)

PRIMARY CSO IMPACTED: 028
PROJECT TYPE: OLS, SPP
2014 LTCP PROJECT: Yes
This project represents a modified version of the project originally proposed in the LTCP to address CSO-028, CSO-044, and CSO-047. The LTCP model results showed that storage was no longer needed to achieve compliance for CSO-044 and CSO-047. To address CSO-028 overflows, the Hopkins and Osage OLS would store flow from the Hopkins Street sewer in a 0.95 MG tank at the eastern end of Osage Street. The storage would dewater when there is available capacity in the South Park Avenue sewer and no risk of overflow at the downstream SPPs 125 and 126. The current OLS configuration requires a pump station for dewatering. This project also includes raising the weir at SPP123A to 2.40 ft (City datum) to send flow to the downstream off-line storage and further reduce CSO-028 overflows.

CSO-033 Projects

CSO-033 overflows to the Buffalo River at the southern end of Bailey Avenue (South Central district). Additional off-line storage projects were selected for this area to handle increased inflow from ECSD#4 and get CSO-033 into compliance.

Bailey & Regent OLS (CSO033_1)

PRIMARY CSO IMPACTED: 033
PROJECT TYPE: OLS
2014 LTCP PROJECT: No
To address CSO-033 overflows, the proposed Bailey & Regent OLS project would store flow from the Bailey Avenue trunk sewer in a 4.50 MG tank at Moreland Field between Regent Street and Moreland Street along Bailey Avenue. The storage would dewater when there is available capacity in the downstream sewer and no risk of overflow at the downstream SPP 104. The current OLS configuration requires a pump station for dewatering.

Clinton St. OLS RTC (CSO033_2)

PRIMARY CSO IMPACTED: 033
PROJECT TYPE: OLS
2014 LTCP PROJECT: No
The Clinton St. OLS project includes adding a new 60” diameter sewer that starts on Clinton Street near Kelburn Street and routes wet weather flow through Houghton Park to a 21.72 MG storage tank. An orifice plate and weir would be added at the intersection of Bailey Avenue and Clinton Street to route more flow to the tank via Clinton Street. An automatically controlled gate at the downstream end of the tank would close to store flow when SPP104 (CSO-033) is at risk for overflow and would open to prevent basement backups upstream. ECSD#4 would get priority in sending flows for treatment, and the storage tank would drain via gravity when there is conveyance capacity available downstream.

SPP104 Modification (CSO033_3)

PRIMARY CSO IMPACTED: 033
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP104 is located on Bailey Avenue, north of Littell Avenue. For this project, the SPP104 overflow weir would be raised to 6.85 ft (City datum), and the length increased to 40’. These modifications would reduce overflows at CSO-017. Since this project is near the Clinton St. OLS, it would be beneficial to implement the SPP104 modification in parallel or after the OLS is constructed.

CSO-053 Projects

The following projects are upstream of SPPs that overflow to CSO-053 on Scajaquada Creek. The operational North Bailey RTC project would be impacted by these new projects and would have its control setpoints adjusted accordingly. Three projects considered upstream of SPP337 were not included in the Selected Alternative because SPP modification was more cost-effective. An additional RTC project upstream of SPP338 was not needed to achieve compliance for that

SPP. One additional OLS site was considered upstream of SPP340 but was not included in the Selected Alternative to consolidate the project area.

SPP336B Sidney Street OLS (CSO053_1.4)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: OLS
2014 LTCP PROJECT: No
To reduce flows at SPP336B, the Sidney Street OLS would store flow diverted from the sewer along Humboldt Parkway in a 3.26 MG tank at the corner of Sidney Street and Lark Street. The storage would dewater via gravity when there is sufficient available capacity in the Scajaquada Tunnel Interceptor.

SPP336B Modification (CSO053_1.5)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP336B is located in the Kensington Expressway, north of Hamlin Road. For this project, SPP336B would be modified by removing the underflow orifice plate, reducing overflows at CSO-053. It would be beneficial to implement this modification after or in parallel with the Sidney OLS project.

SPP337 Modification (CSO053_2.5)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP337 is located near the intersection of Scajaquada Street and Colorado Avenue. For this project, SPP337 would be modified by incorporating an additional 30” diameter underflow pipe. This modification would reduce overflows at CSO-053, and would benefit from the implementation of the Schiller Park OLS or Sidney OLS to free up capacity in the Scajaquada Tunnel.

SPP338 Modification (CSO053_3.1)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP338 is located south of the intersection of Scajaquada Street and Bailey Avenue. For this project, the SPP338 underflow orifice would be enlarged. The overflow weir would be raised to 55.24 ft (City datum), and the length increased to 30’. To prevent construction in the intersection, another version of this project is under consideration that diverts flow upstream of the SPP at Bailey Avenue and Northland Avenue along public open land to tie in to the Scajaquada Tunnel at Scajaquada Street. Either version of this project would reduce overflows at CSO-053 and would benefit from the implementation of the Schiller Park OLS or Sidney OLS.

Bailey & Amherst, Amherst Quarry PS RTC (CSO053_3.2)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: RTC/OLS
2014 LTCP PROJECT: Yes
This RTC project includes adding RTC at SPP255 (Bailey Avenue and East Amherst Street) as well as improving the efficiency of Amherst Quarry dewatering operations to reduce overflows. The SPP255 RTC component was not part of the 2014 LTCP. RTC at this location would send more flow from the North Bailey sewer to the Amherst Quarry when it has available storage capacity, and the Amherst Quarry pump station would dewater the quarry when there is no risk for overflow at Scajaquada SPPs. This project includes updating sensors at Amherst Quarry and adding instrumentation at SPP338 (Bailey Ave & Kerns Ave).

SPP254 Modification (CSO053_3.3)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
For this project, the overflow weir at SPP254 (located at the intersection of Minnesota Avenue and Bailey Avenue) would be replaced. The new weir elevation would be 82.90 ft (City datum), which is slightly lower than the weir elevation in the LTCP model. Lowering the weir results in more flow being routed to the Amherst Quarry PS storage.

Edison Martha OLS (CSO053_5.2)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: OLS
2014 LTCP PROJECT: No
To address CSO-053 overflows, the proposed Martha and Edison OLS project would store flow diverted from the Edison Avenue trunk sewer in a 2.61 MG tank at the northwest corner of Edison Avenue and Kensington Expressway. The storage would dewater via gravity when there is available capacity in the Edison Avenue trunk sewer.

SPP341A Modification (CSO053_8)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: SPP
2014 LTCP PROJECT: Yes
SPP341A is located on Genesee Street east of Kerns Avenue. For this project, SPP341A would be modified by incorporating an additional 18” diameter underflow pipe and raising the overflow weir to 55.60 ft (City datum), reducing overflows at CSO-053. This modification would benefit from the implementation of the Schiller Park OLS or Sidney OLS to free up capacity in the Scajaquada Tunnel.

20% GI Implementation (CSO053_9)

PRIMARY CSO IMPACTED: 011
PROJECT TYPE: GI
2014 LTCP PROJECT: Yes
The CSO-053 basin would have green infrastructure managing 16.7 acres of impervious area. See CSO006_5 description for details.

SPP229A RTC / Jefferson Florida (CSO053_10)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: RTC
2014 LTCP PROJECT: No
SPP229A is located near the intersection of Florida Street and Jefferson Avenue. For this project, SPP229A would be modified by incorporating an additional 24" diameter underflow pipe downstream of a 24" dynamically controlled gate. The gate would open when there is available capacity in the Scajaquada Tunnel or there is a risk for overflow at SPP229A.

Canisius OLS / Jefferson Delavan OLS (CSO053_11)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: OLS
2014 LTCP PROJECT: Yes
This was a planned LTCP project, but there is a new opportunity to move the tank location North and utilize an existing parking garage area at Jefferson and Delavan proposed to be demolished for the construction of a new surface parking lot. In the updated configuration and location, flow at SPP333 is routed to a 1.5 MG offline storage tank. The storage would dewater via gravity when there is capacity available in the Scajaquada Tunnel. Rock is present at shallow depths in this area which would impact construction costs and scheduling.

Jefferson Ave GI (CSO053_12.1)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: Green Infrastructure
2014 LTCP PROJECT: Yes
Permeable pavement would be installed in the parking lanes along Jefferson Avenue from the intersection with Main Street to the intersection with Beverly Road. The design for this project is not complete, but it is assumed that the depth and pore space would match the Kenmore GI project. This project would manage 2.3 acres of impervious area upstream of SPP333.

Jefferson Ave GI (CSO053_12.2)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: Green Infrastructure
2014 LTCP PROJECT: Yes
Permeable pavement would be installed in the parking lanes along Jefferson Avenue from the intersection with Beverly Road to the intersection with Best Street. The design for this project is not complete, but it is assumed that the depth and pore space would match the Kenmore GI project. This project would manage 7.6 acres of impervious area upstream of SPP229A.SPP165B Modification (CSO053_13)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP165B is located at the intersection of East Delavan Avenue and Humboldt Parkway. For this project, the SPP165B underflow orifice would be upsized to 24" and underflow pipe to 36". The overflow weir would also be raised to 54.81 ft (City datum). These modifications would reduce overflows at CSO-053. This project would benefit from the implementation of the Sidney OLS project to make more capacity available in the Scajaquada Tunnel.

SPP175, 176, & 177 Modifications (CSO053_14)

PRIMARY CSO IMPACTED: 053
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
For this project, multiple SPP weirs along Michigan Avenue would be modified to reduce overflows at CSO-053. SPP175 at Dodge Street and Michigan Ave would be raised to 56.10 ft (City datum). SPP176 at Michigan Avenue and Riley Street and SPP177 at Michigan Avenue and Glenwood Avenue would both be raised to 52.85 ft (City datum). These modifications are upstream of the Gates Circle RTC project.

CSO-055 Projects

The following projects impact SPP001 (CSO-055, Niagara River). The controls at the operational Hertel at Deer RTC structure would be adjusted when the upstream projects are implemented. Additional ILS and OLS projects upstream of SPP001 were not included in the Selected Alternative because they did not have a significant impact on overflow volume.

Hertel North East / Hertel Delaware ILS (CSO055_1.1)

PRIMARY CSO IMPACTED: 055
PROJECT TYPE: RTC
2014 LTCP PROJECT: Yes
The Hertel North East ILS is designed to take advantage of additional storage capacity available on Hertel Avenue North barrel upstream of the existing Hertel at Deer RTC structure. Since there is a short travel time between the two locations, the preliminary control strategy would start storage when the depth upstream of the Hertel North East ILS structure indicates wet weather.

Military Rd OLS/Hertel OLS (CSO055_1.5)

PRIMARY CSO IMPACTED: 055
PROJECT TYPE: OLS
2014 LTCP PROJECT: Yes
The Military Road OLS project is a 11.55 MG tank that stores flow diverted from the Hertel Avenue South barrel at the intersection of Hertel Avenue and Military Road. The currently proposed location for the storage tank is the parking lot for West Hertel Academy at 245 Hertel. The inlet of the offline storage is directly upstream of the existing Hertel at Deer RTC structure and would store when the Hertel at Deer ILS is full. The storage would dewater via a pump station when there is no risk of overflow at SPP001. Note that this OLS may not be implemented as it is currently

configured if the North of Scajaquada Creek section of the Northern Relief Tunnel is constructed. Compliance in this area will be further evaluated during the Northern Relief Tunnel detailed design phase, and the Military OLS project will be adjusted as needed to minimize overall program costs while still achieving compliance.

20% GI Implementation (CSO055_3)

PRIMARY CSO IMPACTED: 055
PROJECT TYPE: Green Infrastructure
2014 LTCP PROJECT: Yes
The CSO-055 basin would have green infrastructure managing 260.2 acres of impervious area. See CSO006_5 description for details.

CSO-064 Projects

CSO-064 is a Buffalo River outfall with seven upstream SPPs. One SPP modification project under consideration was not implemented in the Selected Alternative because that SPP was already in compliance.

CSO-064 ILS (CSO064_1.1)

PRIMARY CSO IMPACTED: 064
PROJECT TYPE: ILS
2014 LTCP PROJECT: No
For this project, the existing 24” sewer upstream of SPP137 between South Street and Republic Street along Louisiana Street would be replaced by two 60” diameter sewers. These sewers would provide in-line storage volume to help reduce overflows at SPP137.

SPP 137 Modification (CSO064_1.2)

PRIMARY CSO IMPACTED: 064
PROJECT TYPE: SPP
2014 LTCP PROJECT: No
SPP137 is located at the intersection of Louisiana Street and Republic Street. For this project, the SPP137 overflow weir would be raised to 0.50 ft (City datum). In addition, the underflow orifice plate would be removed. These modifications would reduce overflows at CSO-064 and would be implemented in conjunction with the CSO-064 ILS (CSO064_1.1) project.

Perry Street Sanitary Sewer (CSO064_2)

PRIMARY CSO IMPACTED: 064
PROJECT TYPE: Sewer Replacement
2014 LTCP PROJECT: No
This project would replace an existing sewer partially built into Hamburg Drain. The new sewer would start on Scott St near Illinois St to Louisiana St, then continue along Perry St to the Hamburg St. Pump Station. The total length of new sewer would be 6,417 ft, with the largest pipe diameter being 42”. This project is not anticipated to have a significant impact on CSO-064 overflows.

Selected Alternative Model Results

The following results are from a SWMM simulation of the Selected Alternative with the typical year rainfall input. In addition to including the Selected Alternative projects, this model scenario included updated inflow timeseries for Erie County Sewer Districts 1 and 4 (ECSD#1 and ECSD#4). The inflow update increased the average ECSD#4 inflow from 4.1 mgd to 14.4 mgd over the typical year, while the average ECSD#1 inflow increased from 3.9 mgd to 5.9 mgd.

Hertel District

The Selected Alternative is projected to achieve compliance in the Hertel District, with nine activations at CSO-055 in the typical year.

Scajaquada District

The Selected Alternative is projected to achieve compliance in the Scajaquada District in the typical year:

- CSO-006 (SPPs 179, 180, 331) - The Delavan Drain RTC project (CSO006_3) downstream of the CSO-006 SPPs had one activation in the typical year in the Selected Alternative simulation.
- CSO-004 (SPP013) - SPP013 is in compliance in the Selected Alternative typical year run with only two activations.
- CSO-053 (SPPs 229A, 175, 165B, 338, 336B, 337, 339, 340) - The Selected Alternative achieves compliance for all of the CSO-053 SPPs that were out of compliance in the baseline plan model.

South Central District

The Selected Alternative is projected to achieve compliance for the following CSOs exceeding their target activations in the baseline plan model:

- CSO-029 (SPP126) - CSO-029 has four activations in the Selected Alternative typical year simulation. This is a third of the number of activations expected in the baseline plan model.
- CSO-037 (SPP122) - CSO-037 has five activations in the Selected Alternative model run, which falls under the maximum target of six activations for Cazenovia Creek - C. This is an improvement over the nine activations projected in the baseline plan model.
- CSO-033 (SPP104) - The Selected Alternative is below the target activations with only two activations for this CSO.
- CSO-026 (Smith St. ILS) – CSO-026 is projected to meet the target of six activations in the Selected Alternative typical year.
- CSO-017 (Mill Race ILS) – CSO-017 is projected to fall below the Buffalo River target activations with only four activations in the Selected Alternative scenario.
- CSO-027 (SPP097) – Similar to nearby CSOs, CSO-027 is projected to have only four activations in the Selected Alternative scenario.

Similar to the baseline projects LTCP model, the Selected Alternative is projected to maintain compliance at CSO-014 (SPP 206A&B).

Selected Alternative without GI Comparison

To quantify the impact of GI projects on the Selected Alternative typical year outcomes, a scenario was run without the six 20% GI Implementation projects included. A comparison between the Selected Alternative without GI and the full Selected Alternative with GI is provided in Table 2. CSO-026 is one activation above the target activations for the Buffalo River and CSO-055 is two activations above the target activations for the Niagara River in the Selected Alternative without GI scenario. These out of compliance activations are removed in the Selective Alternative with GI (v3.4.0-ltcp). GI has some systemwide impact on CSOs that did not have GI directly implemented in their sewershed, such as CSO-003, 004, 014, 027, and 061. Overall, including GI in the Selected Alternative reduces systemwide overflow volume by 26.64 MG in the typical year compared to the Selected Alternative without GI.

Table 2. CSO volume and activations comparison between Selected Alternative Without GI and with GI (v3.4.0-ltcp) for CSOs that have a volume reduction > 0.1 MG with GI included.

CSO	Selected Alternative Without GI Typical Year OF Vol. (MG)	Selected Alternative Without GI Typical Year OF Activations	Overflow Volume Reduction with GI, MG	Overflow Volume Reduction with GI, %	Activations Reduction with GI	GI Impervious acres managed	Overflow MG reduced/ impervious acre managed
003	2.28	4	0.13	6%	0		
004	4.74	3	0.82	17%	1		
006	1.62	1	0.61	38%	0	52.5	0.012
011	23.71	4	1.22	5%	0	19.9	0.061
014	6.08	2	0.37	6%	0		
017	42.78	5	4.94	12%	1	37.5	0.132
026	58.91	7	12.77	22%	1	125.5	0.102
027	43.88	5	1.73	4%	1		
053	27.33	4	0.28	1%	0	530	0.001
055	363.77	11	42.97	12%	2	260	0.165
061	9.99	2	0.55	6%	0		

Selected Alternative Typical Year Summary

The Selected Alternative is projected to achieve compliance for all CSOs in the typical year, showing a significant improvement over the LTCP baseline projects model that had 10 CSOs out of compliance. The total residual overflow volume in the Selected Alternative typical year is 551.64 MG, a 66% reduction compared to the updated LTCP model overflow volume of 1618.42 MG. Detailed SWMM results for different model scenarios are provided in Attachment E.

Cost Estimate for Selected Alternative

Detailed planning level opinions of probable construction cost (OPCC) were developed for each of the projects included in the selected alternative. The detailed cost estimates are included in Attachment F. The total capital cost for the Selected Alternative was determined to be $853,763,905.

Methodology & Assumptions

The unit prices and estimate format established during the baseline cost estimate updates were used as the basis for the new projects that were added during this optimization process. To give greater detail in each project's OPCC than was possible using cost curves, site-specific property acquisition requirements and depth to bedrock were determined for each project under consideration, as discussed in the following sections. For locations for which this information was unavailable, placeholder values were used to ensure that the OPCC was not unreasonably low-priced.

Each project's proposed geometry was used to develop its corresponding OPCC, especially in the case of OLS projects. A figure was developed for each OLS project to depict a proposed tank configuration and corresponding influent and effluent sewers that met the dimensional requirements of the model, but also appropriately fit the constraints of each site. These figures are provided in Attachment D. The geometry of each proposed OLS tank generated by the model determined OPCC elements such as the volume of concrete needed for the tank floor, walls, and roof, assuming thicknesses of two feet for these elements. The plan area of the tank was used to determine the number of structural columns and the corresponding volume of concrete required with the assumption of a tributary area of 400 square feet per column. The tank's plan area was increased by 25 percent to determine the amount of site clearing required, and in turn the site clearing area provided the basis for determining the area of pavement or grass restoration required, with the assumption that existing conditions would be restored. Costs for betterment projects associated with site restoration, such as improved park facilities, were not included at this time but may be a consideration as these projects move into detailed design. This site restoration area was also the basis of the property acquisition cost calculation in each OPCC, if the project site was not already publicly owned.

Costs for items such as excavation, sheeting and bracing, and backfill were determined using the proposed tank geometry as well as the depth of existing sewers to which the storage projects would connect. In the case of excavation, the estimated depth to bedrock was compared against the necessary invert for the storage project to determine whether rock excavation was necessary.

The OPCC for each OLS project incorporated conveyance to and from the storage tank and whether pumping was required. These pump costs were obtained from manufacturers' representatives for several design points. Pumps were sized with the assumption that the entire tank storage volume would be dewatered over 24 hours, with two pumps each capable of providing the necessary flowrate for redundancy. OLS tanks involving pumping had line items for pump station buildings, fittings, valves, and gates. Any projects that were modeled with RTC components also incorporated inlet and outlet gates as applicable in their respective OPCC.

The proposed tank invert was the basis for OPCC conveyance calculations involving the necessary depths for excavation, sheeting and bracing, and backfill. The project team collectively reviewed each project and determined the likely connection points to the existing collection system, which in turn determined the lengths of conveyance required for each proposed OLS project.

Following meetings with BSA and the project team, OPCC calculations for projects that did not fall within the OLS category were developed with the following assumptions:

- Green infrastructure projects were estimated to cost $200,000 per acre.
- RTC/ILS projects were given a placeholder cost of $4 million each based on projects completed to date. For the RTC/ILS projects that have progressed into detailed design, the most recent design cost estimates were used.
- SPP modifications were given a placeholder cost of $50,000 each.
- Detailed OPCCs were prepared for each sewer separation project based on the assumption that new storm sewers and catch basins would be installed on the designated streets. Pipe sizes and lengths used in the estimate were based on modeled conditions.

Each project's OPCC included percentage-based add-on costs as shown in the table below (Table 3).

Table 3. Percentage-based add-on costs for individual projects

Item	Amount
Electrical, Controls, and Instrumentation	15% of OPCC subtotal
Utility Relocation / Coordination	5% of OPCC subtotal
Maintenance and Protection of Traffic (MPT)	5% of OPCC subtotal
General Conditions, Bonds & Insurance	5% of OPCC subtotal + three items above

The OPCC was then summed for each Selected Alternative project and a contingency percentage reflective of the project's design stage was added to the subtotal to determine each project's anticipated capital cost. A contingency of 40% was used for the OLS tanks and sewer separation projects; 20% was applied to the SPP modifications; and no additional contingency was added to the green infrastructure or RTC/ILS project estimates.

Detailed OPCCs and the overall cost summary sheet for the selected alternative are provided in Attachment F.

Project-specific life cycle costs have also been developed. In general, these estimates are based on each projects' anticipated operation and maintenance (O&M) requirements and the labor rates relevant to each O&M activity, the present and future cost of replacement equipment and maintenance supplies, and any expected electricity and water usage at the project site. The cost of initial spare parts was assumed to be included in the project's construction costs. The life cycle costs were developed for a fifty-year period using an annual interest rate of 5% and an annual inflation rate of 4.5% to determine their total present value.

The cost items included in each project's life cycle cost analysis varied by project type. Specifically, OLS tanks with pump stations incorporated the following elements:

- Operator monitoring of tank at one hour per week
- Electrical usage by dewatering pumps based on anticipated number of activations from the typical year model
- Water usage by cleaning equipment
- Communication plans for instrumentation and controls and building alarms
- Weekly maintenance checks performed by millwrights and instrument techs
- Bi-weekly maintenance checks performed by a yard and ground maintenance crew
- Quarterly maintenance activities by millwrights and laborers

- Annual maintenance activities including tank cleaning and force main pigging by BSA Sewer Maintenance crews
- Annual property maintenance costs, such as fence or landscaping repairs
- Prorated costs for crews, trucks, combination sewer cleaning vehicles, and skid steers
- Minor pump rehabilitation every two years
- Major pump rehabilitation every five years
- Instrumentation and electrical upgrades and replacement every five years
- Pump station building and HVAC equipment upgrades every ten years
- Cleaning equipment replacement every twenty years
- Mid-lifespan engineering evaluation
- Pump and metal replacement at year 25
- MCC cabinet replacement and major pump station building improvements at year 30

Life cycle costs for OLS tanks dewatered by gravity were based on the following items:

- Operator monitoring of tank at one hour per week
- Water usage by cleaning equipment
- Communication plan for instrumentation and controls
- Weekly maintenance checks performed by millwrights and instrument techs
- Annual maintenance activities including tank cleaning and force main pigging by BSA Sewer Maintenance crews
- Prorated costs for crews, trucks, combination sewer cleaning vehicles, and skid steers
- Instrumentation and electrical upgrades and replacement every five years
- Cleaning equipment replacement every twenty years
- Mid-lifespan engineering evaluation
- Metal replacement at year 25

Life cycle costs for RTS/ILS projects are based on BSA's experience with their existing facilities, including:

- Operator monitoring of tank at one hour per week
- Electrical usage by the gate actuators
- Communication plan for instrumentation and controls
- Weekly maintenance checks performed by instrument techs
- Quarterly maintenance activities by millwrights and laborers
- Annual maintenance and cleaning activities by BSA Sewer Maintenance crews
- Prorated costs for a crew trucks and combination sewer cleaning vehicle
- Minor actuator service every two years
- Major actuator service every five years
- Instrumentation and electrical upgrades and replacement every five years
- Control panel component parts replacement every ten years
- Mid-lifespan engineering evaluation
- Actuator and metal replacement at year 25

Sewer separation project life cycle costs were determined for the anticipated O&M needs of the new storm sewer; specifically:

- Annual allocation for sewer repairs
- Jet cleaning and CCTV every five years
- Minor manhole and catch basin maintenance at year 10
- Major manhole and catch basin maintenance at year 25

Life cycle costs for green infrastructure projects were determined for the anticipated O&M needs of permeable pavement; specifically:

- Purchase of pavement vacuum
- Weekly fuel for pavement vacuum
- Debris disposal
- Labor for pavement vacuum operator
- Pavement repair or replacement every ten years

Since BSA already owns and maintains their sewer patrol points, modifications to these structures would only have a minor impact on their expected life cycle costs. An additional hour has been allocated bi-weekly for a crew of two inspectors to monitor the SPPs that will be modified.

The Northern Relief Tunnel is expected to operate hydraulically, similar to BSA's existing interceptors. Life cycle costs for this tunnel were determined based on the following anticipated O&M needs:

- Operator monitoring of tunnel at one hour per week
- Communication plan for instrumentation and controls
- Instrumentation upgrades and/or replacement every five years
- Inspection, cleaning and routine maintenance by an outside contractor every five years

Property Requirements for Selected Alternative

The proposed GI and OLS projects can be located on either City-owned property or on private property. Obtaining permission to use City-owned property would not require purchasing land but the owning agency would need to give permission for the proposed use. Projects located on private property would require an easement or a land purchase to construct. The projects that are not anticipated to require property purchase can be seen in Table 4, as the proposed locations are already owned by the City of Buffalo or related agencies.

Table 4. Projects that do not require property acquisition

Project	City Property
CSO014_1.2 Erie Basin Marina OLS	95 4th St, Buffalo, NY 14202
CSO017 Bass Alley OLS	22 Seymour Street
CSO026_1.3 Collins Park OLS	317 Smith St, Buffalo, NY 14210
CSO028_1 Hopkins & Osage OLS	Park at Hopkins and Osage St. (Durant Park)
CSO033_1 Bailey & Regent OLS (Moreland Park)	1351 Bailey Ave, Buffalo, NY 14210
CSO053_1.4 SPP336B OLS (Sidney OLS)	28 Sidney St, Buffalo, NY 14211
CSO053_12.1 Jefferson Ave GI	Jefferson Ave from Main St to Beverly Rd
CSO053_12.2 Jefferson Ave GI	Jefferson Ave from Best St to Beverly Rd
CSO055_1.5 Military Rd OLS	489 Hertel Ave, Buffalo, NY 14207
System_2 Schiller Park OLS	2057 Genesee St, Buffalo, NY 14211

Most Off-line Storage (OLS) tanks are planned to be located under City parks, which appear to be good sites for OLS projects because of their open land and ability to be returned to park space after an underground tank is constructed. Constructing an OLS tank would require coordination with the City of Buffalo Parks Department.

GI implementation along Jefferson Ave is envisioned to be permeable pavement using similar construction to what was done on William Street, Kenmore Ave, and Ohio St. The permeable pavement will be within the public right of way and the design will need to be coordinated with City of Buffalo Engineering. The rest of the GI projects are envisioned to be impervious area management projects, primarily permeable pavement within the public right of way to expedite implementation and ensure compliance with deadlines set forth by regulators and with funding mechanisms and lower long-term maintenance costs. Other methodologies including rain gardens, road diets, green and blue roofs, bioswales, and downspout disconnections will be considered as opportunities present themselves to work in conjunction with other entities in this space. The specific locations for GI implementation projects (CSO006_5, CSO011_1.1, CSO017_4, CSO026_4, and CSO055_3) will be determined as private and public opportunities present themselves and in conformance with the GI Master Plan and Rain Check 1.0 and 2.0 Reports. Implementation will require coordination with the City of Buffalo.

Projects that will likely require property acquisition can be seen in Table 5. Most projects have multiple options for siting on either private or public property. Private property installations would require land purchase or easement which experience has shown is frequently an extended process and a significant cause for delay in the implementation of mandated work. Use of City-owned property would also require coordination with the City but might be easier to arrange.

Table 5. Projects that may require property acquisition and/or BSA easements

Project	City Option	Private Option
CSO053_11 Canisius OLS	N/A	Canisius College
CSO053_5.2 Edison Martha OLS	430 Edison Ave, Buffalo, NY 14215	154 City Line, Buffalo, NY 14215
Northern Relief Tunnel (System_1)	166 Dart Street, Buffalo, NY 14213 Tonawanda at Arthur	Railroad Easement near Tonawanda and Austin, Rich Products Parking Lot,

Draft Implementation Schedule

Project Priority Evaluation

The objective of the draft implementation schedule for the Selected Alternative is to present a reasonable timeline that provides the most benefit to Buffalo communities. A scoring matrix has been developed to help meet this objective by prioritizing the construction schedule. The scoring matrix includes the factors listed in Table 6. The SPP associated with each project is based on the SPP that is closest downstream or is expected to have the largest volume/activations reduction when the project is implemented. The Waterbody Rank was weighted higher than the other factors to prioritize implementing projects that reduce overflows to high priority waterbodies. The projects with the lowest combined score should be implemented earlier in the schedule where possible.

Table 6. Project Ranking System

No.	Factor	Score Conditions		
		1	**2**	**3**
1	SPP Overflow Volume Rank	Baseline typical year SPP overflow volume > 5 MG	Baseline typical year SPP overflow between 1 and 5 MG	Baseline typical year SPP overflow volume < 1 MG
2	Waterbody Rank	Black Rock Canal and Scajaquada Creek SPPs	Buffalo River SPPs	Erie Basin and Niagara River SPPs
3	SPP Project Rank	Highest priority project upstream of a particular SPP based on cost effectiveness	2nd Highest priority project upstream of a particular SPP based on cost effectiveness	3rd highest priority project upstream of a particular SPP based on cost effectiveness
4	Construction Priority	Construction planned/occurring soon	Normal priority	Avoiding construction in this area due to concerns such as contaminated soil, high traffic, etc.
5	CSO Cost Effectiveness	Combined cost effectiveness of projects in CSO basin $/gal reduction < $1	Combined cost effectiveness of projects in CSO basin $/gal reduction > $1 and < $2	Combined cost effectiveness of projects in CSO basin $/gal reduction > $3
6	Environmental Justice (EJ)	Disadvantage ranking > 4	Disadvantage ranking > 2 and ≤ 4	Disadvantage ranking ≤ 2

The Environmental Justice (EJ) factor has a more complex set of inputs than the other factors to represent a range of factors related to socioeconomic disadvantage and vulnerability, exposure to environmental risks, and access to environmental amenities that can then be used to determine equity voids. To determine a project's priority in terms of Environmental Justice, the Climate and Economic Justice Screening Tool (CEJST) developed by the Council on Environmental Quality (CEQ) was used to identify disadvantaged communities in the City of Buffalo. The CEJST tool is also used by the Justice40 Initiative, a federal government approach to ensure that 40% of the overall benefits of federal investment flow to disadvantaged communities (The White House). Hence, using the same screening tool as the Justice40 Initiative will ensure that projects in disadvantaged neighborhoods are prioritized and BSA's goal of advancing environmental justice is met.

CEJST uses datasets of burden indicators. These burdens are organized into eight categories (Table 7). A community is highlighted as disadvantaged on the map if it is in a census tract that is at or above the threshold for one or more environmental, climate, or other burdens, and at or above the threshold for an associated socioeconomic burden. In addition, a census tract surrounded by disadvantaged communities and at or above the 50% percentile for low-income is also considered disadvantaged (Council on Environmental Quality, 2022).

Table 7. CEJST Categories of Burdens Evaluated for Selected Alternative Projects (Council on Environmental Quality, 2022).

No.	Category	Threshold for Environmental, climate, or other burdens	Threshold for Socioeconomic Burden
1	Climate change	At or above the 90th percentile for expected agriculture loss rate, expected building loss rate, expected population loss rate, projected flood risk, or projected wildfire risk	At or above the 65th percentile for low income
2	Energy	At or above the 90th percentile for energy cost or PM2.5 in the air	At or above the 65th percentile for low income
3	Health	At or above the 90th percentile for asthma, diabetes, heart disease, or low life expectancy	At or above the 65th percentile for low income
4	Housing	Experienced historic underinvestment or are at or above the 90th percentile for the housing cost, lack of green space, lack of indoor plumbing, or lead paint	At or above the 65th percentile for low income
5	Legacy pollution	Have at least one abandoned mine land or Formerly Used Defense Sites or are at or above the 90th percentile for proximity to hazardous waste facilities, proximity to Superfund sites (National Priorities List (NPL)), or proximity to Risk Management Plan (RMP) facilities	At or above the 65th percentile for low income
6	Transportation	At or above the 90th percentile for diesel particulate matter exposure, transportation barriers, or traffic proximity and volume	At or above the 65th percentile for low income
7	Water and wastewater	At or above the 90th percentile for underground storage tanks and releases or wastewater discharge	At or above the 65th percentile for low income
8	Workforce development	At or above the 90th percentile for linguistic isolation, low median income, poverty, or unemployment	Fewer than 10% of people ages 25 or older have a high school education (i.e., graduated with a high school diploma)

The Selected Alternative Projects & Disadvantaged Communities map (Attachment G) was created based on these CEJST categories of burdens. Even though there are 8 CEJST categories of burdens, the highest disadvantage ranking observed in the City of Buffalo was 6, meaning a census tract was highlighted as disadvantaged in 6 categories of burdens. Conversely, the lowest disadvantage ranking observed in the City was 0, meaning the census tract was not

disadvantaged in any categories of burdens evaluated. Subsequently, the Selected Alternative projects were plotted over the disadvantaged community map to determine the disadvantage raking for each project.

There were two approaches to calculating the disadvantage ranking for each project based on project type:

- GI Projects: The overall project disadvantage ranking was calculated using the weighted average of the disadvantage rankings for the census tracts where GI was applied in the sewershed.
- All other projects (OLS, RTC, ILS, and SPP Modifications): A quarter-mile radius buffer zone was drawn around each of these projects to estimate each project's area of influence, and the census tract's highest disadvantage score within that project's radius became the project's disadvantage ranking.

Out of the 51 Selected Alternative projects, 67% of the projects have a disadvantage ranking of greater than 4 and are primarily located towards the south of the City, 24% of the projects have a disadvantage ranking of less or equal to 4 but greater than 2, and 9% of the projects have a disadvantage ranking of less or equal to 2 (Attachment G). These percentages indicate that most proposed projects are located in more vulnerable neighborhoods.

These resources provide a visual way for BSA and stakeholders to better understand the citywide distribution of need, deprivation, and risk. Since BSA seeks to engage communities equitably, the disadvantaged community evaluation will also help inform the community engagement plan for each project.

Project Dependencies

In addition to individual project priorities, dependencies need to be taken account during project scheduling. Some projects that are in near proximity to each other, such as the SPP336B Modification (CSO053_1.5) and SPP336B OLS (Sidney OLS, CSO053_1.4), would make most sense to implement in parallel or in short succession to make construction coordination easier and maximize the project benefits. Many SPP modification projects send more flow to downstream interceptors, so their implementation is dependent on the construction of projects upstream that help reduce interceptor peak flows. An example of this dependency is the Schiller Park OLS and Sidney OLS projects making more capacity available in the Scajaquada Tunnel that could be used by multiple SPP modification projects.

There may also be other project dependencies outside the scope of the Selected Alternative projects to ease coordination with other public and private entities. For example, implementation of some projects in park spaces make be dependent on the Buffalo parks department's future budget and construction plans. These dependencies will be taken into account as the schedule is further refined.

Project Timelines

The timeline for each type of project was established with assumptions of how long it would take to complete project phases including Environmental Finance Center (EFC) engineering reports, site surveys and inspections, Basis of Design reports, detailed design, bidding, and construction. More complex (major) projects such as off-line storage tanks and the Northern Relief Tunnel are

expected to take longer than typical RTC projects. For the draft implementation schedule, it was assumed that BSA could have 5 major and 7 minor projects in construction simultaneously.

Development of the schedule included assumptions for how long it would take to complete a project based on typical constraints to BSA and projects within Buffalo, and construction times for similar projects. Based on this information, the following general task times were used in construction of the schedule (Table 8). Larger or smaller projects like the Northern Relief Tunnel were given custom times to reflect the complexity of the project.

Table 8. General Task Durations Applied in Schedule Development

Task	Duration by Project Type (months)					
	Real-Time Control	Off-Line Storage	In-Line Storage	SPP Modification	Green Infrastructure	Tunnel
Engineering Report	4	6	6	4	6	12
Site Investigation	2	3	3	2	1	24
Basis of Design Report	2	2	2	2	N/A	12
Detailed Design	12	12	12	3	9	24
City Coordination/ Land Acquisition	N/A	12	N/A	N/A	N/A	24
Bidding	6	6	6	6	6	9
City Review Time Before Contract Award	2	2	2	2	2	2
Construction	24	36	24	4	12	48

An estimated timeline for the design and construction of the projects included in the Selected Alternative is presented in Attachment H. Estimated engineering start and construction finish dates are summarized in Table C.1 (Attachment C).

Conclusion & Next Steps

The projects described herein as the Selected Alternative represent an updated proposal for capital improvements to meet the LTCP requirements. This set of projects makes significant progress towards compliance and improved water quality. BSA will continue to optimize the effectiveness of these projects as a globally coordinated control strategy is implemented, collection system monitoring continues, and additional system improvements are made. While the overall Selected Alternative cost is anticipated to be higher than the cost of the original LTCP plan, the projects included in the Selected Alternative will achieve the target level of control for all waterbodies. The preliminary schedule for phasing of the Selected Alternative has a target completion date of 2040.

References

Council on Environmental Quality. (2022, November 22). *Methodology*. Climate and Economic Justice Screening Tool. https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5

The White House. (n.d.) *Justice40*. https://www.whitehouse.gov/environmentaljustice/justice40/

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Attachment A

LTCP BASELINE PROJECTS

Project Number 299

Note:
1. X+1 Volume is the estimated volume required to meet the required level of control at a sewer patrol point..

SPP001
X + 1 Volume
= 21.41 MGal

CSO 055
(Military
Road)

Northern Relief Tunnel

SPP-331

SPP180
X + 1 Volume
= 0.22 MGal

SPP170
X + 1 Volume
= 1.02 MGal

SPP333
X + 1 Volume
= 0.51 MGal

Jefferson
& Florida

SPP168
X + 1 Volume
= 0.16 MGal

SPP231
X + 1 Volume
= 0.25 MGal

SPP229A
X + 1 Volume
= 0.14 MGal

SPP336 Group

SPP336B
X + 1 Volume
= 6.18 MGal

SPP337
X + 1 Volume
= 1.93 MGal

SPP337

SPP338
X + 1 Volume
= 2.32 MGal

SPP339
X + 1 Volume
= 2.39 MGal

SPP341A
X + 1 Volume
= 0.86 MGal

SPP340
X + 1 Volume
= 3.05 MGal

SPP021
X + 1 Volume
= 0.72 MGal

SPP023
X + 1 Volume
= 0.61 MGal

SPP256
X + 1 Volume
= 2.94 MGal

SPP024
X + 1 Volume
= 7.27 MGal

SPP175
X + 1 Volume
= 0.13 MGal

CSO 013

SPP206A
X + 1 Volume
= 0.84 MGal

SPP206B
X + 1 Volume
= 0.84 MGal

CSO 014/015
Satellite
Storage

SPP326
X + 1 Volume
= 1.1 MGal

SPP065
X + 1 Volume
= 0.4 MGal

SPP059
X + 1 Volume
= 0.17 MGal

SPP067
X + 1 Volume
= 4.19 MGal

SPP137
X + 1 Volume
= 0.17 MGal

CSO 064

SPP097
X + 1 Volume
= 1.63 MGal

CSO 027

CSO 033/050

CSO
028/037/044/047

SPP126
X + 1 Volume
= 0.2 MGal

SPP104
X + 1 Volume
= 3.47 MGal

CSO 052

SPP102
X + 1 Volume
= 0.3 MGal

SPP123A
X + 1 Volume
= 0.74 MGal

Legend

- Sewer Patrol Point
- Preferred Alt - Satellite Storage
- Baseline Project
- ≤0.158 MGal
- Out of Compliance Sewer Patrol Points
- ≤21.4 MGal

Paper Size ARCH D

0 0.5 1 1.5

Miles

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD83 New York West ftUS

N

xylem Let's Solve Water

ARCADIS

GHD

BUFFALO SEWER AUTHORITY
WET WEATHER OPERATIONS OPTIMIZATION
CSO LTCP PROJECTS OPTIMIZATION

LTCP BASELINE PROJECTS

Project No. **11225567**
Date **02/18/2022**

FIGURE 1

Attachment B

UPDATED BASELINE PROJECT COSTS

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN PREFERRED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST FOR PROJECTS NOT STARTED

Work Area	January 2014 Future Cost [1,2,3]	01/24/2023 Updated Baseline Costs
CSO 013 (300,000 gallons)	$ 3,000,000	$ 7,700,000
CSO 014/015 (800,000 gallons)	$ 6,700,000	$ 16,600,000
CSO 028/044/047 (2,300,000 gallons)	$ 12,200,000	$ 29,200,000
CSO 052 (600,000 gallons)	$ 3,900,000	$ 9,900,000
CSO 055 (7,500,000 gallons)	$ 18,500,000	$ 45,200,000
CSO 064 (100,000 gallons)	$ 2,000,000	$ 5,500,000
Jefferson & Florida (SPP 170B) (2,600,000 gallons)	$ 9,500,000	$ 23,800,000
SPP 336 a/b (SPP165A, SPP165B, SPP 336A, SPP336B) (4,200,000 gallons)	$ 11,500,000	$ 31,200,000
SPP 337	$ 4,000,000	$ 10,000,000
North Relief Sewer	$ 36,000,000	$ 72,810,744
Underflow Upsizing (CSO 008/010, 061, 004)	$ 500,000	$ 675,000
Subtotal	*$ 107,800,000*	$ 252,585,744
Contingency (20%)	$ 21,500,000	$ 50,500,000
Probable Construction Cost	*$ 129,300,000*	$ 303,085,744
Administrative and Legal (5%)	$ 6,500,000	$ 15,000,000
Engineering (20%)	$ 26,000,000	$ 60,500,000
Total Recommended Plan Cost	**$ 161,800,000**	**$ 378,585,744**
Revised Foundation Plan	$ 85,000,000	
Green Infrastructure	$ 92,600,000	$ 324,000,000
Total Preferred Alternative Cost	**$ 339,400,000**	**$ 702,585,744**

(1) Year 2012 dollars.
(2) All Costs Rounded.
(3) Planning Level Estimate

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN PREFERRED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

DRAFT

CSO 013

4/5/2012 (Unit costs in blue updated February 2022)

Description	Basis	No. Units	Material Per Unit	Material Subtotal	Per Unit	Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Per Unit	Subtotal	Total Cost [2]	Total Cost [2]	Source of Unit Price
Satellite Storage (0.3 MG)													
Land Acquisition	Acres	1	$ 25,000	$ 25,000	$ 100,000	$ 100,000	$ -	$ -			$ 25,000	$ 100,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab) = $33,750; increased based on local experience, including consultant fees
Survey & Stake-out	LS	1	$ 27,000	$ 27,000	$ 36,450	$ 36,450	$ -	$ -		$ -	$ 27,000	$ 36,450	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Site Clearing	SF	4,203	$ 2	$ 8,406	$ 2.70	$ 11,348	$ -	$ -		$ -	$ 8,406	$ 11,348	see 2021 Unit Cost Backup tab
Excavation	CY	3,623	$ 40	$ 144,900	$ 40	$ 144,900	$ -	$ -		$ -	$ 144,900	$ 144,900	see 2021 Unit Cost Backup tab
Rock Excavation	CY	3,623			$ 200	$ 724,500						$ 724,500	assume half of excavation quantity will be rock; see 2021 Unit Cost Backup tab
Piles / Foundation	LS	1			$ 500,000	$ 500,000						$ 500,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Bedding	CY	223	$ 50	$ 11,150	$ 77	$ 17,171	$ -	$ -		$ -	$ 11,150	$ 17,171	see 2021 Unit Cost Backup tab
Concrete	CY	772	$ 1,000	$ 772,000	$ 1,600	$ 1,235,200	$ -	$ -		$ -	$ 772,000	$ 1,235,200	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -		$ -	$ 500,000	$ 500,000	$ 675,000	$ 675,000	$ 500,000	$ 675,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	12,760	$ 15	$ 191,400	$ 46	$ 586,960	$ -	$ -		$ -	$ 191,400	$ 586,960	see 2021 Unit Cost Backup tab
Backfill	CY	4,900	$ 10	$ 49,000	$ 44	$ 215,600	$ -	$ -		$ -	$ 49,000	$ 215,600	see 2021 Unit Cost Backup tab
Hauling	CY	2,346	$ 10	$ 23,460	$ 14	$ 31,671	$ -	$ -		$ -	$ 23,460	$ 31,671	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cleaning Equipment	LS	1	$ 90,000	$ 90,000	$ 121,500	$ 121,500	$ 45,000	$ 45,000	$ 60,750	$ 60,750	$ 135,000	$ 182,250	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Access Manholes	EA	3	$ 2,500	$ 7,500	$ 3,100	$ 9,300	$ -	$ -		$ -	$ 7,500	$ 9,300	see 2021 Unit Cost Backup tab
Miscellaneous Site Restoration	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on local experience; to repair staging areas, misc. damage to site
Grass Restoration	SY	2,500	$ 6	$ 15,000	$ 9	$ 22,500	$ -	$ -		$ -	$ 15,000	$ 22,500	see 2021 Unit Cost Backup tab; tank = 467 SY, site = 0.5 acre = 2500 SY
Satellite Storage Conveyance													
Excavation	CY	543	$ 40	$ 21,720	$ 40	$ 21,720	$ -	$ -			$ 21,720	$ 21,720	see 2021 Unit Cost Backup tab
Bedding	CY	82	$ 50	$ 4,100	$ 77	$ 6,314	$ -	$ -			$ 4,100	$ 6,314	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	4,888	$ 15	$ 73,320	$ 46	$ 224,848	$ -	$ -			$ 73,320	$ 224,848	see 2021 Unit Cost Backup tab
Backfill	CY	418	$ 10	$ 4,180	$ 44	$ 18,392	$ -	$ -			$ 4,180	$ 18,392	see 2021 Unit Cost Backup tab
Hauling	CY	125	$ 10	$ 1,250	$ 14	$ 1,688	$ -	$ -			$ 1,250	$ 1,688	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
4 ft Concrete Pipe	LF	94	$ 350	$ 32,900	$ 473	$ 44,415	$ -	$ -			$ 32,900	$ 44,415	1.35 inflation markup (see ENR 20 City Avg CCI Data tab). Requested cost from Forterra.
Cut Access into Main Interceptor	EA	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Manholes	EA	0	$ 2,500	$ -	$ 3,100	$ -	$ -	$ -			$ -	$ -	see 2021 Unit Cost Backup tab
Satellite Storage Force Main													
Excavation	CY	233	$ 40	$ 9,320	$ 40	$ 9,320	$ -	$ -			$ 9,320	$ 9,320	see 2021 Unit Cost Backup tab
Bedding	CY	73	$ 50	$ 3,650	$ 77	$ 5,621	$ -	$ -			$ 3,650	$ 5,621	see 2021 Unit Cost Backup tab
Backfill	CY	159	$ 10	$ 1,590	$ 44	$ 6,996	$ -	$ -			$ 1,590	$ 6,996	see 2021 Unit Cost Backup tab
Hauling	CY	74	$ 10	$ 740	$ 14	$ 999	$ -	$ -			$ 740	$ 999	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cut Access into Main Interceptor	EA	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pig Launcher	LS	1			$ 20,000	$ 20,000						$ 20,000	
4" ID pipe	LF	368	$ 10	$ 3,680	$ 17	$ 6,072	$ -	$ -			$ 3,680	$ 6,072	see 2021 Unit Cost Backup tab
Satellite Storage Pump Station													
Pumps	EA	2	$ 15,000	$ 30,000	$ 20,250	$ 40,500	$ 7,500	$ 15,000	$ 10,125	$ 20,250	$ 45,000	$ 60,750	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pump Station Building	SF	100	$ 200	$ 20,000	$ 2,000	$ 200,000	$ -	$ -			$ 20,000	$ 200,000	based on Babcock PS RTC work
Piles / Foundation	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Piping in Tank (Including Bends)	LF	100	$ 150	$ 15,000	$ 203	$ 20,250	$ -	$ -			$ 15,000	$ 20,250	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Check Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Gate Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Wet Well Isolation Gates	EA	2	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 40,000	$ 54,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Misc Metals (Grating, Handrail, Monorails, Etc.)	LS	1	$ 50,000	$ 50,000	$ 150,000	$ 150,000	$ -	$ -			$ 50,000	$ 150,000	1.35 inflation markup = $67,500; use $150,000 based on Babcock PS RTC plus market increase; includes trash rack, hatches
Start-up and testing	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
												$ 5,787,235	
						Subtotal					**$ 2,400,000**	**$ 5,800,000**	
						Electrical, Controls and Instrumentation (15%)					**$ 400,000**	**$ 900,000**	
						Utility Relocation / Coordination (5%)						**$ 300,000**	
						MPT (5%)						**$ 300,000**	
						General Conditions, Bonds & Insurance (5% of Subtotal)					**$ 100,000**	**$ 400,000**	
						Total Probable Construction Cost (Rounded)					**$ 2,900,000**	**$ 7,700,000**	

(1) For items without installation cost, installation cost is included in material price.
(2) Year 2012 dollars. Does not include engineering, administrative, and legal costs or contingency.

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN PREFERRED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

DRAFT

CSO 014, 15
4/5/2012 (Unit costs in blue updated February 2022)

Description	Material Basis	Material No. Units	Material Per Unit	Material Subtotal	Material Per Unit	Material Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Total Cost [2]	Total Cost [2]	Source of Unit Price
Satellite Storage (0.8 MG)													
Land Acquisition	Acres	1	$ 25,000	$ 25,000	$ 100,000	$ 100,000	$ -	$ -			$ 25,000	$ 100,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab) = $33,750; increased based on local experience
Survey & Stake-out	LS	1	$ 27,000	$ 27,000	$ 36,450	$ 36,450	$ -	$ -			$ 27,000	$ 36,450	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Site Clearing	SF	23,053	$ 2	$ 43,800	$ 2.70	$ 62,242	$ -	$ -			$ 43,800	$ 62,242	see 2021 Unit Cost Backup tab
Excavation	CY	5,590	$ 40	$ 223,580	$ 40	$ 223,580	$ -	$ -			$ 223,580	$ 223,580	see 2021 Unit Cost Backup tab
Rock Excavation	CY	5,590			$ 200	$ 1,117,900						$ 1,117,900	assume half of excavation quantity will be rock; see 2021 Unit Cost Backup tab
Piles / Foundation	LS	1			$ 500,000	$ 500,000						$ 500,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Bedding	CY	416	$ 50	$ 20,800	$ 77	$ 32,032	$ -	$ -			$ 20,800	$ 32,032	see 2021 Unit Cost Backup tab
Concrete	CY	1,415	$ 1,000	$ 1,415,000	$ 1,600	$ 2,264,000	$ -	$ -			$ 1,415,000	$ 2,264,000	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 500,000	$ 500,000	$ 675,000	$ 675,000	$ 500,000	$ 675,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	15,600	$ 15	$ 234,000	$ 46	$ 717,600	$ -	$ -			$ 234,000	$ 717,600	see 2021 Unit Cost Backup tab
Backfill	CY	5,771	$ 10	$ 57,710	$ 44	$ 253,924	$ -	$ -			$ 57,710	$ 253,924	see 2021 Unit Cost Backup tab
Hauling	CY	1,297	$ 10	$ 12,970	$ 14	$ 17,510	$ -	$ -			$ 12,970	$ 17,510	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cleaning Equipment	LS	1	$ 90,000	$ 90,000	$ 121,500	$ 121,500	$ 40,500	$ 40,500	$ 54,675	$ 54,675	$ 130,500	$ 176,175	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Access Manholes	EA	3	$ 2,500	$ 7,500	$ 3,100	$ 9,300	$ -	$ -			$ 7,500	$ 9,300	see 2021 Unit Cost Backup tab
Miscellaneous Site Restoration	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on local experience; to repair staging areas, misc. damage to site
Pavement Restoration	SF	23,053	$ 10	$ 230,525	$ 11	$ 253,578	$ -	$ -			$ 230,525	$ 253,578	see 2021 Unit Cost Backup tab
Satellite Storage Conveyance 1													
Excavation	CY	8,664	$ 40	$ 346,560	$ 40	$ 346,560	$ -	$ -			$ 346,560	$ 346,560	see 2021 Unit Cost Backup tab
Bedding	CY	1,151	$ 50	$ 57,550	$ 77	$ 88,627	$ -	$ -			$ 57,550	$ 88,627	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	71,980	$ 15	$ 1,079,700	$ 46	$ 3,311,080	$ -	$ -			$ 1,079,700	$ 3,311,080	see 2021 Unit Cost Backup tab
Backfill	CY	6,818	$ 10	$ 68,180	$ 44	$ 299,992	$ -	$ -			$ 68,180	$ 299,992	see 2021 Unit Cost Backup tab
Hauling	CY	1,846	$ 10	$ 18,460	$ 14	$ 24,921	$ -	$ -			$ 18,460	$ 24,921	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
4.5 ft Concrete Pipe	LF	1,180	$ 200	$ 236,000	$ 270	$ 318,600	$ -	$ -			$ 236,000	$ 318,600	1.35 inflation markup (see ENR 20 City Avg CCI Data tab). Requested cost from Forterra.
Cut Access into Main Interceptor	LS	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Manholes	EA	5	$ 2,500	$ 11,800	$ 3,100	$ 15,500	$ -	$ -			$ 11,800	$ 15,500	see 2021 Unit Cost Backup tab
Satellite Storage Conveyance 2													
Excavation	CY	306	$ 40	$ 12,240	$ 40	$ 12,240	$ -	$ -			$ 12,240	$ 12,240	see 2021 Unit Cost Backup tab
Bedding	CY	39	$ 50	$ 1,950	$ 77	$ 3,003	$ -	$ -			$ 1,950	$ 3,003	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	3,009	$ 15	$ 45,135	$ 46	$ 138,414	$ -	$ -			$ 45,135	$ 138,414	see 2021 Unit Cost Backup tab
Backfill	CY	249	$ 10	$ 2,490	$ 44	$ 10,956	$ -	$ -			$ 2,490	$ 10,956	see 2021 Unit Cost Backup tab
Hauling	CY	57	$ 10	$ 570	$ 14	$ 770	$ -	$ -			$ 570	$ 770	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
3.5 ft Concrete Pipe	LF	51	$ 200	$ 10,200	$ 270	$ 13,770	$ -	$ -			$ 10,200	$ 13,770	1.35 inflation markup (see ENR 20 City Avg CCI Data tab). Requested cost from Forterra.
Cut Access into Main Interceptor	EA	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Manholes	EA	0	$ 2,500	$ -	$ 3,100	$ -	$ -	$ -			$ -	$ -	see 2021 Unit Cost Backup tab
Satellite Storage Force Main													
Excavation	CY	400	$ 40	$ 16,000	$ 40	$ 16,000	$ -	$ -			$ 16,000	$ 16,000	see 2021 Unit Cost Backup tab
Bedding	CY	132	$ 50	$ 6,600	$ 77	$ 10,164	$ -	$ -			$ 6,600	$ 10,164	see 2021 Unit Cost Backup tab
Backfill	CY	261	$ 10	$ 2,610	$ 44	$ 11,484	$ -	$ -			$ 2,610	$ 11,484	see 2021 Unit Cost Backup tab
Hauling	CY	139	$ 10	$ 1,390	$ 14	$ 1,877	$ -	$ -			$ 1,390	$ 1,877	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cut Access into Main Interceptor	EA	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pig Launcher	LS	1			$ 20,000	$ 20,000						$ 20,000	
8" ID Pipe	LF	528	$ 30	$ 15,840	$ 30	$ 15,840	$ -	$ -			$ 15,840	$ 15,840	see 2021 Unit Cost Backup tab
Satellite Storage Pump Station													
Pumps	EA	2	$ 20,000	$ 40,000	$ 27,000	$ 54,000	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 60,000	$ 81,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pump Station Building	SF	100	$ 200	$ 20,000	$ 2,000	$ 200,000	$ -	$ -			$ 20,000	$ 200,000	based on Babcock PS RTC work
Piles / Foundation	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Piping in Tank (Including Bends)	LF	100	$ 150	$ 15,000	$ 203	$ 20,250	$ -	$ -			$ 15,000	$ 20,250	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Check Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Gate Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Wet Well Isolation Gates	EA	2	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 40,000	$ 54,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Misc Metals (Grating, Handrail, Monorails, Etc.)	LS	1	$ 50,000	$ 50,000	$ 150,000	$ 150,000	$ -	$ -			$ 50,000	$ 150,000	1.35 inflation markup = $67,500; use $150,000 based on Babcock PS RTC plus market increase; includes trash rack, hatches
Start-up and testing	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
												$ 12,182,337	
								Subtotal			**$ 5,300,000**	**$ 12,200,000**	
								Electrical, Controls and Instrumentation (15%)			**$ 800,000**	**$ 1,800,000**	
								Utility Relocation / Coordination (5%)				**$ 600,000**	
								Environmental Remediation (5%)				**$ 600,000**	
								MPT (5%)				**$ 600,000**	
								General Conditions, Bonds & Insurance (5% of Subtotal)			**$ 300,000**	**$ 800,000**	
								Total Probable Construction Cost (Rounded)			**$ 6,400,000**	**$ 16,600,000**	

(1) For items without installation cost, installation cost is included in material price.
(2) Year 2012 dollars. Does not include engineering, administrative, and legal costs or contingency.

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN PREFERRED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

DRAFT

CSO 028/044/047
4/5/2012 (Unit costs in blue updated February 2022)

Description	Material Basis	Material No. Units	Material Per Unit	Material Subtotal	Material Per Unit	Material Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Total Cost [2]	Total Cost [2]	Source of Unit Price
Satellite Storage (2.3 MG)													
Land Acquisition	Acres	2	$ 25,000	$ 50,000	$ 500,000	$ 1,000,000	$ -	$ -			$ 50,000	$ 1,000,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab) = $33,750; increased based on local experience, including consultant fees
Survey & Stake-out	LS	1	$ 27,000	$ 27,000	$ 36,450	$ 36,450	$ -	$ -			$ 27,000	$ 36,450	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Site Clearing	SF	29,620	$ 2	$ 56,277	$ 2.70	$ 79,973	$ -	$ -			$ 56,277	$ 79,973	see 2021 Unit Cost Backup tab
Excavation	CY	6,080	$ 40	$ 243,180	$ 40	$ 243,180	$ -	$ -			$ 243,180	$ 243,180	see 2021 Unit Cost Backup tab
Rock Excavation	CY	6,080			$ 200	$ 1,215,900						$ 1,215,900	assume half of excavation quantity will be rock; see 2021 Unit Cost Backup tab
Piles / Foundation	LS	1			$ 1,000,000	$ 1,000,000						$ 1,000,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Bedding	CY	2,339	$ 50	$ 116,950	$ 77	$ 180,103	$ -	$ -			$ 116,950	$ 180,103	see 2021 Unit Cost Backup tab
Concrete	CY	2,799	$ 1,000	$ 2,799,000	$ 1,600	$ 4,478,400	$ -	$ -			$ 2,799,000	$ 4,478,400	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 500,000	$ 500,000	$ 675,000	$ 675,000	$ 500,000	$ 675,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	28,080	$ 15	$ 421,200	$ 46	$ 1,291,680	$ -	$ -			$ 421,200	$ 1,291,680	see 2021 Unit Cost Backup tab
Hauling	CY	14,280	$ 10	$ 142,800	$ 14	$ 192,780	$ -	$ -			$ 142,800	$ 192,780	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Backfill	CY	12,097	$ 10	$ 120,970	$ 44	$ 532,268	$ -	$ -			$ 120,970	$ 532,268	see 2021 Unit Cost Backup tab
Cleaning Equipment	LS	1	$ 90,000	$ 90,000	$ 121,500	$ 121,500	$ 45,000	$ 45,000	$ 60,750	$ 60,750	$ 135,000	$ 182,250	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Access Manholes	EA	3	$ 2,500	$ 7,500	$ 3,100	$ 9,300	$ -	$ -			$ 7,500	$ 9,300	see 2021 Unit Cost Backup tab
Miscellaneous Site Restoration	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on local experience; to repair staging areas, misc. damage to site
Grass Restoration	SY	194	$ 6	$ 1,161	$ 9	$ 1,742	$ -	$ -			$ 1,161	$ 1,742	see 2021 Unit Cost Backup tab
Pavement Restoration	SF	11,311	$ 10	$ 113,105	$ 11	$ 124,416	$ -	$ -			$ 113,105	$ 124,416	see 2021 Unit Cost Backup tab
Satellite Storage Conveyance 1													
Site Clearing	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Excavation	CY	12,159	$ 40	$ 486,360	$ 40	$ 486,360	$ -	$ -			$ 486,360	$ 486,360	see 2021 Unit Cost Backup tab
Bedding	CY	2,339	$ 50	$ 116,950	$ 77	$ 180,103	$ -	$ -			$ 116,950	$ 180,103	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 100,000	$ 100,000	$ 135,000	$ 135,000	$ 100,000	$ 135,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	CY	119,379	$ 15	$ 1,790,685	$ 46	$ 5,491,434	$ -	$ -			$ 1,790,685	$ 5,491,434	see 2021 Unit Cost Backup tab
Backfill	CY	8,730	$ 10	$ 87,300	$ 44	$ 384,120	$ -	$ -			$ 87,300	$ 384,120	see 2021 Unit Cost Backup tab
Hauling	CY	3,429	$ 10	$ 34,290	$ 14	$ 46,292	$ -	$ -				$ 46,292	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
3.5' RCP Pipe	LF	3,061	$ 200	$ 612,200	$ 270	$ 826,470	$ -	$ -			$ 612,200	$ 826,470	1.35 inflation markup (see ENR 20 City Avg CCI Data tab). Requested cost from Forterra.
Cut Access into Main Interceptor	LS	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Manholes	EA	12	$ 2,500	$ 30,610	$ 3,100	$ 37,200	$ -	$ -			$ 30,610	$ 37,200	see 2021 Unit Cost Backup tab
Satellite Storage Conveyance 2													
Site Clearing	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Excavation	CY	1,898	$ 40	$ 75,920	$ 40	$ 75,920	$ -	$ -			$ 75,920	$ 75,920	see 2021 Unit Cost Backup tab
Bedding	CY	388	$ 50	$ 19,400	$ 77	$ 29,876	$ -	$ -			$ 19,400	$ 29,876	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 100,000	$ 100,000	$ 121,060	$ 121,060	$ 100,000	$ 121,060	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	CY	12,060	$ 15	$ 180,900	$ 46	$ 554,760	$ -	$ -			$ 180,900	$ 554,760	see 2021 Unit Cost Backup tab
Backfill	LF	1,181	$ 10	$ 11,810	$ 44	$ 51,964	$ -	$ -			$ 11,810	$ 51,964	see 2021 Unit Cost Backup tab
Hauling	CY	717	$ 10	$ 7,170	$ 14	$ 9,680	$ -	$ -			$ 7,170	$ 9,680	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
6.5' RCP Pipe	LF	268	$ 600	$ 160,800	$ 810	$ 217,080	$ -	$ -			$ 160,800	$ 217,080	1.35 inflation markup (see ENR 20 City Avg CCI Data tab). Requested cost from Forterra.
Cut Access into Main Interceptor	EA	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Mahnoles	EA	5	$ 2,500	$ 12,500	$ 3,100	$ 15,500	$ -	$ -			$ 12,500	$ 15,500	see 2021 Unit Cost Backup tab
Force Main													
Site Clearing	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Excavation	CY	531	$ 40	$ 21,240	$ 40	$ 21,240	$ -	$ -			$ 21,240	$ 21,240	see 2021 Unit Cost Backup tab
Bedding	CY	182	$ 50	$ 9,100	$ 77	$ 14,014	$ -	$ -			$ 9,100	$ 14,014	see 2021 Unit Cost Backup tab
Hauling	CY	199	$ 10	$ 1,990	$ 14	$ 2,687	$ -	$ -			$ 1,990	$ 2,687	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Backfill	CY	332	$ 10	$ 3,320	$ 44	$ 14,608	$ -	$ -			$ 3,320	$ 14,608	see 2021 Unit Cost Backup tab
Cut Access into Main Interceptor	EA	1	$ 12,500	$ 12,500	$ 16,875	$ 16,875	$ -	$ -			$ 12,500	$ 16,875	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pig Launcher	LS	1			$ 20,000	$ 20,000						$ 20,000	
12 in ID Pipe	LF	597	$ 30	$ 17,910	$ 95	$ 56,715	$ -	$ -			$ 17,910	$ 56,715	see 2021 Unit Cost Backup tab
Satellite Storage Pumping													
Pumps	EA	2	$ 40,000	$ 80,000	$ 54,000	$ 108,000	$ 20,000	$ 40,000	$ 27,000	$ 54,000	$ 120,000	$ 162,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pump Station Building	SF	100	$ 200	$ 20,000	$ 2,000	$ 200,000	$ -	$ -			$ 20,000	$ 200,000	based on Babcock PS RTC work
Piles / Foundation	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Piping in Tank (inc. Bends)	LF	50	$ 150	$ 7,500	$ 203	$ 10,125	$ -	$ -			$ 7,500	$ 10,125	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Check Valves	EA	2	$ 25,000	$ 50,000	$ 33,750	$ 67,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 70,000	$ 94,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Gate Valves	EA	2	$ 25,000	$ 50,000	$ 33,750	$ 67,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 70,000	$ 94,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Wet Well Isolation Gates	EA	2	$ 50,000	$ 100,000	$ 67,500	$ 135,000	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 120,000	$ 162,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Misc Metals (Grating, Handrail, Monorails, Etc.)	LS	1	$ 750,000	$ 750,000	$ 1,012,500	$ 1,012,500	$ -	$ -			$ 750,000	$ 1,012,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Start-up and testing	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
												$ 22,177,023	
								Subtotal			**$ 9,900,000**	**$ 22,200,000**	
								Electrical, Controls and Instrumentation (15%)			**$ 1,500,000**	**$ 3,300,000**	
								Utility Relocation / Coordination (5%)				**$ 1,100,000**	
								MPT (5%)				**$ 1,100,000**	
								General Conditions, Bonds & Insurance (5% of Subtotal)			**$ 600,000**	**$ 1,400,000**	
								Legal Costs Associated with Private Land Acqusition and Restortation (10%)				**$ 122,616**	
								Total Probable Construction Cost (Rounded)			**$ 12,000,000**	**$ 29,200,000**	

(1) For items without installation cost, installation cost is included in material price.

(2) Year 2012 dollars. Does not include engineering, administrative, and legal costs or contingency.

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN PREFERRED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

DRAFT

CSO 052
4/5/2012 (Unit costs in blue updated February 2022)

Description	Material Basis	Material No. Units	Material Per Unit	Material Subtotal	Material Per Unit	Material Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Total Cost [2]	Total Cost [2]	Source of Unit Price
Satellite Storage (0.6 MG)													
Land Acquisition	Acres	1	$ 25,000	$ 25,000	$ 500,000	$ 500,000	$ -	$ -			$ 25,000	$ 500,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab) = $33,750; increased based on local experience, including consultant fees
Survey & Stake-out	LS	1	$ 27,000	$ 27,000	$ 36,450	$ 36,450	$ -	$ -			$ 27,000	$ 36,450	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Site Clearing	SF	4,708	$ 2	$ 9,416	$ 2.70	$ 12,712	$ -	$ -			$ 9,416	$ 12,712	see 2021 Unit Cost Backup tab
Excavation	CY	4,477	$ 40	$ 179,060	$ 40	$ 179,060	$ -	$ -			$ 179,060	$ 179,060	see 2021 Unit Cost Backup tab
Rock Excavation	CY	4,477			$ 200	$ 895,300						$ 895,300	assume half of excavation quantity will be rock; see 2021 Unit Cost Backup tab
Piles / Foundation	LS	1			$ 500,000	$ 500,000						$ 500,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Bedding	CY	312	$ 50	$ 15,600	$ 77	$ 24,024	$ -	$ -			$ 15,600	$ 24,024	see 2021 Unit Cost Backup tab
Concrete	CY	1,149	$ 1,000	$ 1,149,000	$ 1,600	$ 1,838,400	$ -	$ -			$ 1,149,000	$ 1,838,400	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 500,000	$ 500,000	$ 675,000	$ 675,000	$ 500,000	$ 675,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	13,940	$ 15	$ 209,100	$ 46	$ 641,240	$ -	$ -			$ 209,100	$ 641,240	see 2021 Unit Cost Backup tab
Backfill	CY	4,737	$ 10	$ 47,370	$ 44	$ 208,428	$ -	$ -			$ 47,370	$ 208,428	see 2021 Unit Cost Backup tab
Hauling	CY	4,216	$ 10	$ 42,160	$ 14	$ 56,916	$ -	$ -			$ 42,160	$ 56,916	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cleaning Equipment	LS	1	$ 90,000	$ 90,000	$ 121,500	$ 121,500	$ 45,000	$ 45,000	$ 60,750	$ 60,750	$ 135,000	$ 182,250	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Access Manholes	EA	3	$ 2,500	$ 7,500	$ 3,100	$ 9,300	$ -	$ -			$ 7,500	$ 9,300	see 2021 Unit Cost Backup tab
Pavement Restoration	SF	49	$ 10	$ 489	$ 11	$ 538	$ -	$ -			$ 489	$ 538	see 2021 Unit Cost Backup tab
Miscellaneous Site Restoration	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on local experience; to repair staging areas, misc. damage to site
Grass Restoration	SY	2,500	$ 6	$ 15,000	$ 9	$ 22,500	$ -	$ -		$ -	$ 15,000	$ 22,500	see 2021 Unit Cost Backup tab; tank = 668 SY, site = 0.5 acre = 2500 SY
Satellite Storage Conveyance													
Excavation	CY	601	$ 40	$ 24,040	$ 40	$ 24,040	$ -	$ -			$ 24,040	$ 24,040	see 2021 Unit Cost Backup tab
Bedding	CY	100	$ 50	$ 5,000	$ 77	$ 7,700	$ -	$ -			$ 5,000	$ 7,700	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	7,216	$ 15	$ 108,240	$ 46	$ 331,936	$ -	$ -			$ 108,240	$ 331,936	see 2021 Unit Cost Backup tab
Backfill	CY	469	$ 10	$ 4,690	$ 44	$ 20,636	$ -	$ -			$ 4,690	$ 20,636	see 2021 Unit Cost Backup tab
Hauling	CY	132	$ 10	$ 1,320	$ 14	$ 1,782	$ -	$ -			$ 1,320	$ 1,782	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
2.5 ft Concrete Pipe	LF	176	$ 250	$ 44,000	$ 338	$ 59,400	$ -	$ -			$ 44,000	$ 59,400	1.35 inflation markup (see ENR 20 City Avg CCI Data tab). Requested cost from Forterra.
Cut Access into Main Interceptor	LS	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Manholes	EA	0	$ 2,500	$ -	$ 3,100	$ -	$ -	$ -			$ -	$ -	see 2021 Unit Cost Backup tab
Satellite Storage Force Main													
Excavation	CY	928	$ 40	$ 37,120	$ 40	$ 37,120	$ -	$ -			$ 37,120	$ 37,120	see 2021 Unit Cost Backup tab
Bedding	CY	300	$ 50	$ 15,000	$ 77	$ 23,100	$ -	$ -			$ 15,000	$ 23,100	see 2021 Unit Cost Backup tab
Backfill	CY	619	$ 10	$ 6,190	$ 44	$ 27,236	$ -	$ -			$ 6,190	$ 27,236	see 2021 Unit Cost Backup tab
Hauling	CY	309	$ 10	$ 3,090	$ 14	$ 4,172	$ -	$ -			$ 3,090	$ 4,172	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cut Access into Main Interceptor	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pig Launcher	LS	1			$ 20,000	$ 20,000						$ 20,000	
6" ID Pipe	LF	1,336	$ 15	$ 20,040	$ 23	$ 31,062	$ -	$ -			$ 20,040	$ 31,062	see 2021 Unit Cost Backup tab
Satellite Storage Pump Station													
Pumps	EA	2	$ 20,000	$ 40,000	$ 27,000	$ 54,000	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 60,000	$ 81,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pump Station Building	SF	100	$ 200	$ 20,000	$ 2,000	$ 200,000	$ -	$ -			$ 20,000	$ 200,000	based on Babcock PS RTC work
Piles / Foundation	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Piping in Tank (Including Bends)	LF	350	$ 150	$ 52,500	$ 203	$ 70,875	$ -	$ -			$ 52,500	$ 70,875	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Check Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Gate Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Wet Well Isolation Gates	EA	2	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 40,000	$ 54,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Misc Metals (Grating, Handrail, Monorails, Etc.)	LS	1	$ 50,000	$ 50,000	$ 150,000	$ 150,000	$ -	$ -			$ 50,000	$ 150,000	1.35 inflation markup = $67,500; use $150,000 based on Babcock PS RTC plus market increase; includes trash rack, hatches
Start-up and testing	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
												$ 7,369,176	
						Subtotal					**$ 3,000,000**	**$ 7,400,000**	
						Electrical, Controls and Instrumentation (15%)					**$ 500,000**	**$ 1,100,000**	
						Utility Relocation / Coordination (5%)						**$ 400,000**	
						MPT (5%)						**$ 400,000**	
						General Conditions, Bonds & Insurance (5% of Subtotal)					**$ 200,000**	**$ 500,000**	
						Legal Costs Associated with Private Land Acqusition and Restortation (10%)						**$ 62,304**	
						Total Probable Construction Cost (Rounded)					**$ 3,700,000**	**$ 9,900,000**	

(1) For items without installation cost, installation cost is included in material price.
(2) Year 2012 dollars. Does not include engineering, administrative, and legal costs or contingency.

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN PREFERRED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

DRAFT

CSO 055
4/5/2012 (Unit costs in blue updated February 2022)

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Material Per Unit	Material Subtotal	Installation (1) Per Unit	Installation (1) Subtotal	Installation (1) Per Unit	Installation (1) Subtotal	Total Cost (2)	Total Cost (2)	Source of Unit Price
Satellite Storage (7.5 MG)													
Land Acquisition	Acres	3	$ 25,000	$ 75,000	$ 100,000	$ 300,000	$ -	$ -			$ 75,000	$ 300,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab) = $33,750; increased based on local experience, including consultant fees
Site Clearing	SF	20,867	$ 2	$ 41,733	$ 2.70	$ 56,340	$ -	$ -			$ 41,733	$ 56,340	see 2021 Unit Cost Backup tab
Survey & Stake-out	LS	1	$ 27,000	$ 27,000	$ 36,450	$ 36,450	$ -	$ -			$ 27,000	$ 36,450	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Excavation	CY	44,574	$ 40	$ 1,782,960	$ 40	$ 1,782,960	$ -	$ -			$ 1,782,960	$ 1,782,960	see 2021 Unit Cost Backup tab
Rock Excavation	CY	44,574			$ 200	$ 8,914,800						$ 8,914,800	assume half of excavation quantity will be rock; see 2021 Unit Cost Backup tab
Piles / Foundation	LS	1			$ 2,000,000	$ 2,000,000						$ 2,000,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Bedding	CY	3,112	$ 50	$ 155,600	$ 77	$ 239,624	$ -	$ -			$ 155,600	$ 239,624	see 2021 Unit Cost Backup tab
Concrete	CY	8,091	$ 1,000	$ 8,091,000	$ 1,600	$ 12,945,600	$ -	$ -			$ 8,091,000	$ 12,945,600	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 500,000	$ 500,000	$ 675,000	$ 675,000	$ 500,000	$ 675,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	53,040	$ 15	$ 795,600	$ 46	$ 2,439,840	$ -	$ -			$ 795,600	$ 2,439,840	see 2021 Unit Cost Backup tab
Backfill	CY	44,020	$ 10	$ 440,200	$ 44	$ 1,936,880	$ -	$ -			$ 440,200	$ 1,936,880	see 2021 Unit Cost Backup tab
Hauling	CY	45,128	$ 10	$ 451,280	$ 14	$ 609,228	$ -	$ -			$ 451,280	$ 609,228	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Access Manholes	EA	3	$ 2,500	$ 7,500	$ 3,100	$ 9,300	$ -	$ -			$ 7,500	$ 9,300	see 2021 Unit Cost Backup tab
Pavement Restoration	SF	23,200	$ 10	$ 232,000	$ 11	$ 255,200	$ -	$ -			$ 232,000	$ 255,200	see 2021 Unit Cost Backup tab
Cleaning Equipment	LS	1	$ 135,000	$ 135,000	$ 182,250	$ 182,250	$ 67,500	$ 67,500	$ 91,125	$ 91,125	$ 202,500	$ 273,375	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Start-up and testing	LS	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Miscellaneous Site Restoration	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on local experience; to repair staging areas, misc. damage to site
Grass Restoration	SY	2,319	$ 6	$ 13,911	$ 9	$ 20,867	$ -	$ -			$ 13,911	$ 20,867	see 2021 Unit Cost Backup tab
Satellite Storage Conveyance													
Excavation	CY	800	$ 40	$ 32,000	$ 40	$ 32,000	$ -	$ -			$ 32,000	$ 32,000	see 2021 Unit Cost Backup tab
Bedding	CY	132	$ 50	$ 6,600	$ 77	$ 10,164	$ -	$ -			$ 6,600	$ 10,164	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	5,400	$ 15	$ 81,000	$ 46	$ 248,400	$ -	$ -			$ 81,000	$ 248,400	see 2021 Unit Cost Backup tab
Backfill	CY	563	$ 10	$ 5,630	$ 44	$ 24,772	$ -	$ -			$ 5,630	$ 24,772	see 2021 Unit Cost Backup tab
Hauling	CY	237	$ 10	$ 2,370	$ 14	$ 3,200	$ -	$ -			$ 2,370	$ 3,200	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
6 ft Concrete Pipe	LF	100	$ 500	$ 50,000	$ 675	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab). Requested cost from Forterra.
Cut Access into Main Interceptor	LS	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Manholes	EA	0	$ 2,500	$ -	$ 3,100	$ -	$ -	$ -			$ -	$ -	see 2021 Unit Cost Backup tab
Satellite Storage Force Main													
Excavation	CY	471	$ 40	$ 18,840	$ 40	$ 18,840	$ -	$ -			$ 18,840	$ 18,840	see 2021 Unit Cost Backup tab
Bedding	CY	167	$ 50	$ 8,350	$ 77	$ 12,859	$ -	$ -			$ 8,350	$ 12,859	see 2021 Unit Cost Backup tab
Backfill	CY	272	$ 10	$ 2,720	$ 44	$ 11,968	$ -	$ -			$ 2,720	$ 11,968	see 2021 Unit Cost Backup tab
Hauling	CY	199	$ 10	$ 1,990	$ 14	$ 2,687	$ -	$ -			$ 1,990	$ 2,687	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cut Access into Main Interceptor	LS	1	$ 15,000	$ 15,000	$ 20,250	$ 20,250	$ -	$ -			$ 15,000	$ 20,250	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pig Launcher	LS	1			$ 20,000	$ 20,000						$ 20,000	
20" ID Pipe	LF	400	$ 50	$ 20,000	$ 380	$ 152,000	$ -	$ -			$ 20,000	$ 152,000	see 2021 Unit Cost Backup tab
Satellite Storage Pump Station													
Pumps	EA	2	$ 80,000	$ 160,000	$ 108,000	$ 216,000	$ 40,000	$ 80,000	$ 54,000	$ 108,000	$ 240,000	$ 324,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pump Station Building	SF	100	$ 200	$ 20,000	$ 2,000	$ 200,000	$ -	$ -			$ 20,000	$ 200,000	based on Babcock PS RTC work
Piles / Foundation	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Piping in Tank (Including Bends)	LF	75	$ 150	$ 11,250	$ 203	$ 15,188	$ -	$ -			$ 11,250	$ 15,188	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Check Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Gate Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Wet Well Isolation Gates	EA	2	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 40,000	$ 54,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Misc Metals (Grating, Handrail, Monorails, Etc	LS	1	$ 50,000	$ 50,000	$ 150,000	$ 150,000	$ -	$ -			$ 50,000	$ 150,000	1.35 inflation markup = $67,500; use $150,000 based on Babcock PS RTC plus market increase; includes trash rack, hatches
Start-up and testing	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
												$ 34,360,290	
						Subtotal					**$ 13,600,000**	**$ 34,400,000**	
						Electrical, Controls and Instrumentation (15%)					**$ 2,000,000**	**$ 5,200,000**	
						Utility Relocation / Coordination (5%)						**$ 1,700,000**	
						MPT (5%)						**$ 1,700,000**	
						General Conditions, Bonds & Insurance (5% of Subtotal)					**$ 800,000**	**$ 2,200,000**	
						Total Probable Construction Cost (Rounded)					**$ 16,400,000**	**$ 45,200,000**	

(1) For items without installation cost, installation cost is included in material price.
(2) Year 2012 dollars. Does not include engineering, administrative, and legal costs or contingency.

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN PREFERRED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

DRAFT

CSO 064
4/5/2012 (Unit costs in blue updated February 2022)

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Material Per Unit	Material Subtotal	Installation (1) Per Unit	Installation (1) Subtotal	Installation (1) Per Unit	Installation (1) Subtotal	Total Cost (2)	Total Cost (2)	Source of Unit Price
Satellite Storage (0.1 MG)													
Land Acquisition	Acres	1	$ 25,000	$ 25,000	$ 100,000	$ 100,000	$ -	$ -			$ 25,000	$ 100,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab) = $33,750; increased based on local experience, including consultant fees
Survey & Stake-out	LS	1	$ 27,000	$ 27,000	$ 36,450	$ 36,450	$ -	$ -			$ 27,000	$ 36,450	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Site Clearing	SF	1,910	$ 2	$ 3,820	$ 2.70	$ 5,157	$ -	$ -			$ 3,820	$ 5,157	see 2021 Unit Cost Backup tab
Excavation	CY	1,431	$ 40	$ 57,220	$ 40	$ 57,220	$ -	$ -			$ 57,220	$ 57,220	see 2021 Unit Cost Backup tab
Rock Excavation	CY	1,431			$ 200	$ 286,100						$ 286,100	assume half of excavation quantity will be rock; see 2021 Unit Cost Backup tab
Piles / Foundation	LS	1			$ 500,000	$ 500,000						$ 500,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Bedding	CY	90	$ 50	$ 4,500	$ 77	$ 6,930	$ -	$ -			$ 4,500	$ 6,930	see 2021 Unit Cost Backup tab
Concrete	CY	356	$ 1,000	$ 356,000	$ 1,600	$ 569,600	$ -	$ -			$ 356,000	$ 569,600	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 500,000	$ 500,000	$ 675,000	$ 675,000	$ 500,000	$ 675,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	6,840	$ 15	$ 102,600	$ 46	$ 314,640	$ -	$ -			$ 102,600	$ 314,640	see 2021 Unit Cost Backup tab
Backfill	CY	2,006	$ 10	$ 20,060	$ 44	$ 88,264	$ -	$ -			$ 20,060	$ 88,264	see 2021 Unit Cost Backup tab
Hauling	CY	856	$ 10	$ 8,560	$ 14	$ 11,556	$ -	$ -			$ 8,560	$ 11,556	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cleaning Equipment	LS	1	$ 45,000	$ 45,000	$ 60,750	$ 60,750	$ 22,500	$ 22,500	$ 30,375	$ 30,375	$ 67,500	$ 91,125	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Access Manholes	EA	3	$ 2,500	$ 7,500	$ 3,100	$ 9,300	$ -	$ -			$ 7,500	$ 9,300	see 2021 Unit Cost Backup tab
Pavement Restoration	SF	1,010	$ 10	$ 10,100	$ 11	$ 11,110	$ -	$ -			$ 10,100	$ 11,110	see 2021 Unit Cost Backup tab
Miscellaneous Site Restoration	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on local experience; to repair staging areas, misc. damage to site
Grass Restoration	SY	2,500	$ 6	$ 15,000	$ 9	$ 22,500	$ -	$ -		$ -	$ 15,000	$ 22,500	see 2021 Unit Cost Backup tab; tank = 100 SY, site = 0.5 acre = 2500 SY
Satellite Storage Conveyance													
Excavation	CY	238	$ 40	$ 9,520	$ 40	$ 9,520	$ -	$ -			$ 9,520	$ 9,520	see 2021 Unit Cost Backup tab
Bedding	CY	46	$ 50	$ 2,300	$ 77	$ 3,542	$ -	$ -			$ 2,300	$ 3,542	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	2,340	$ 15	$ 35,100	$ 46	$ 107,640	$ -	$ -			$ 35,100	$ 107,640	see 2021 Unit Cost Backup tab
Backfill	CY	171	$ 10	$ 1,710	$ 44	$ 7,524	$ -	$ -			$ 1,710	$ 7,524	see 2021 Unit Cost Backup tab
Hauling	CY	67	$ 10	$ 670	$ 14	$ 905	$ -	$ -			$ 670	$ 905	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
4.5 ft Concrete Pipe	LF	60	$ 200	$ 12,000	$ 270	$ 16,200	$ -	$ -			$ 12,000	$ 16,200	1.35 inflation markup (see ENR 20 City Avg CCI Data tab). Requested cost from Forterra.
Cut Access into Main Interceptor	LS	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Manholes	EA	0	$ 2,500	$ -	$ 3,100	$ -	$ -	$ -			$ -	$ -	see 2021 Unit Cost Backup tab
Satellite Storage Force Main													
Excavation	CY	2,133	$ 40	$ 85,320	$ 40	$ 85,320	$ -	$ -			$ 85,320	$ 85,320	see 2021 Unit Cost Backup tab
Bedding	CY	730	$ 50	$ 36,500	$ 77	$ 56,210	$ -	$ -			$ 36,500	$ 56,210	see 2021 Unit Cost Backup tab
Backfill	CY	1,333	$ 10	$ 13,330	$ 44	$ 58,652	$ -	$ -			$ 13,330	$ 58,652	see 2021 Unit Cost Backup tab
Hauling	CY	800	$ 10	$ 8,000	$ 14	$ 10,800	$ -	$ -			$ 8,000	$ 10,800	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cut Access into Main Interceptor	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pig Launcher	LS	1			$ 20,000	$ 20,000						$ 20,000	
4" ID Pipe	LF	2,400	$ 15	$ 36,000	$ 17	$ 39,600	$ -	$ -			$ 36,000	$ 39,600	see 2021 Unit Cost Backup tab
Satellite Storage Pump Station													
Pumps	EA	2	$ 15,000	$ 30,000	$ 20,250	$ 40,500	$ 7,500	$ 15,000	$ 10,125	$ 20,250	$ 45,000	$ 60,750	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pump Station Building	SF	100	$ 200	$ 20,000	$ 2,000	$ 200,000	$ -	$ -			$ 20,000	$ 200,000	based on Babcock PS RTC work
Piles / Foundation	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Piping in Tank (Including Bends)	LF	75	$ 150	$ 11,250	$ 203	$ 15,188	$ -	$ -			$ 11,250	$ 15,188	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Check Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Gate Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Wet Well Isolation Gates	EA	2	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 40,000	$ 54,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Misc Metals (Grating, Handrail, Monorails, Etc	LS	1	$ 50,000	$ 50,000	$ 150,000	$ 150,000	$ -	$ -			$ 50,000	$ 150,000	1.35 inflation markup = $67,500; use $150,000 based on Babcock PS RTC plus market increase; includes trash rack, hatches
Start-up and testing	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
												$ 4,123,802	
						Subtotal					**$ 1,800,000**	**$ 4,200,000**	
						Electrical, Controls and Instrumentation (15%)					**$ 300,000**	**$ 600,000**	
						Utility Relocation / Coordination (5%)						**$ 200,000**	
						MPT (5%)						**$ 200,000**	
						General Conditions, Bonds & Insurance (5% of Subtotal)					**$ 100,000**	**$ 300,000**	
						Total Probable Construction Cost (Rounded)					**$ 2,200,000**	**$ 5,500,000**	

(1) For items without installation cost, installation cost is included in material price.
(2) Year 2012 dollars. Does not include engineering, administrative, and legal costs or contingency.

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN PREFERRED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

DRAFT

Jefferson and Flordia
4/5/2012 (Unit costs in blue updated February 2022)

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Material Per Unit	Material Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Total Cost [2]	Total Cost [2]	Source of Unit Price
Satellite Storage (2.6 MG)													
Land Acquisition	Acres	1	$ 25,000	$ 25,000	$ 500,000	$ 500,000	$ -	$ -			$ 25,000	$ 500,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab) = $33,750; increased based on local experience, including consultant fees
Survey & Stake-out	LS	1	$ 27,000	$ 27,000	$ 36,450	$ 36,450	$ -	$ -			$ 27,000	$ 36,450	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Site Clearing	SF	15,410	$ 2	$ 30,820	$ 2.70	$ 41,607	$ -	$ -			$ 30,820	$ 41,607	see 2021 Unit Cost Backup tab
Excavation	CY	13,823	$ 40	$ 552,920	$ 40	$ 552,920	$ -	$ -			$ 552,920	$ 552,920	see 2021 Unit Cost Backup tab
Rock Excavation	CY	13,823			$ 200	$ 2,764,600					$ -	$ 2,764,600	assume half of excavation quantity will be rock; see 2021 Unit Cost Backup tab
Piles / Foundation	LS	1			$ 1,000,000	$ 1,000,000					$ -	$ 1,000,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Bedding	CY	816	$ 50	$ 40,800	$ 77	$ 62,832	$ -	$ -			$ 40,800	$ 62,832	see 2021 Unit Cost Backup tab
Concrete	CY	2,949	$ 1,000	$ 2,949,000	$ 1,600	$ 4,718,400	$ -	$ -			$ 2,949,000	$ 4,718,400	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 500,000	$ 500,000	$ 675,000	$ 675,000	$ 500,000	$ 675,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	48,060	$ 15	$ 720,900	$ 46	$ 2,210,760	$ -	$ -			$ 720,900	$ 2,210,760	see 2021 Unit Cost Backup tab
Backfill	CY	11,734	$ 10	$ 117,340	$ 44	$ 516,296	$ -	$ -			$ 117,340	$ 516,296	see 2021 Unit Cost Backup tab
Hauling	CY	15,912	$ 10	$ 159,120	$ 14	$ 214,812	$ -	$ -			$ 159,120	$ 214,812	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cleaning Equipment	LS	1	$ 95,000	$ 95,000	$ 128,250	$ 128,250	$ 47,500	$ 47,500	$ 64,125	$ 64,125	$ 142,500	$ 192,375	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Access Manholes	EA	3	$ 2,500	$ 7,500	$ 3,100	$ 9,300	$ -	$ -			$ 7,500	$ 9,300	see 2021 Unit Cost Backup tab
Miscellaneous Site Restoration	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on local experience; to repair staging areas, misc. damage to site
Pavement Restoration	SF	15,410	$ 10	$ 154,100	$ 11	$ 169,510	$ -	$ -			$ 154,100	$ 169,510	see 2021 Unit Cost Backup tab
Satellite Storage Conveyance													
Excavation	CY	5,103	$ 40	$ 204,120	$ 40	$ 204,120	$ -	$ -			$ 204,120	$ 204,120	see 2021 Unit Cost Backup tab
Bedding	CY	1,127	$ 50	$ 56,350	$ 77	$ 86,779	$ -	$ -			$ 56,350	$ 86,779	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	39,368	$ 15	$ 590,520	$ 46	$ 1,810,928	$ -	$ -			$ 590,520	$ 1,810,928	see 2021 Unit Cost Backup tab
Backfill	CY	3,223	$ 10	$ 32,230	$ 44	$ 141,812	$ -	$ -			$ 32,230	$ 141,812	see 2021 Unit Cost Backup tab
Hauling	CY	1,880	$ 10	$ 18,800	$ 14	$ 25,380	$ -	$ -			$ 18,800	$ 25,380	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
5 ft Concrete Pipe	LF	1,036	$ 250	$ 259,000	$ 338	$ 349,650	$ -	$ -			$ 259,000	$ 349,650	1.35 inflation markup (see ENR 20 City Avg CCI Data tab). Requested cost from Forterra.
Cut Access into Main Interceptor	LS	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Manholes	EA	4	$ 2,500	$ 10,360	$ 3,100	$ 12,846	$ -	$ -			$ 10,360	$ 12,846	see 2021 Unit Cost Backup tab
Satellite Storage Dewatering													
Excavation	CY	1,407	$ 40	$ 56,280	$ 40	$ 56,280	$ -	$ -			$ 56,280	$ 56,280	see 2021 Unit Cost Backup tab
Bedding	CY	76	$ 50	$ 3,800	$ 77	$ 5,852	$ -	$ -			$ 3,800	$ 5,852	see 2021 Unit Cost Backup tab
Sheeting/Bracing	SF	23,997	$ 15	$ 359,955	$ 46	$ 1,103,862	$ -	$ -			$ 359,955	$ 1,103,862	see 2021 Unit Cost Backup tab
Backfill	CY	1,322	$ 10	$ 13,220	$ 44	$ 58,168	$ -	$ -			$ 13,220	$ 58,168	see 2021 Unit Cost Backup tab
Hauling	CY	85	$ 10	$ 850	$ 14	$ 1,148	$ -	$ -			$ 850	$ 1,148	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cut Access into Main Interceptor	LS	1	$ 12,500	$ 12,500	$ 16,875	$ 16,875	$ -	$ -			$ 12,500	$ 16,875	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pig Launcher	LS	1			$ 20,000	$ 20,000						$ 20,000	
12" ID Pipe	LF	230	$ 35	$ 8,050	$ 95	$ 21,850	$ -	$ -			$ 8,050	$ 21,850	see 2021 Unit Cost Backup tab
Satellite Storage Monitoring													
Wet Well Isolation Gates	EA	2	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 40,000	$ 54,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Misc Metals (Grating, Handrail, Monorails, Etc	LS	1	$ 50,000	$ 50,000	$ 150,000	$ 150,000	$ -	$ -			$ 50,000	$ 150,000	1.35 inflation markup = $67,500; use $150,000 based on Babcock PS RTC plus market increase; includes trash rack, hatches
												$ 18,019,412	
								Subtotal			**$ 7,200,000**	**$ 18,100,000**	
								Electrical, Controls and Instrumentation (15%)			**$ 1,100,000**	**$ 2,700,000**	
								Utility Relocation / Coordination (5%)				**$ 900,000**	
								MPT (5%)				**$ 900,000**	
								General Conditions, Bonds & Insurance (5% of Subtotal)			**$ 400,000**	**$ 1,100,000**	
								Legal Costs Associated with Private Land Acqusition and Restortation (10%)				**$ 76,951**	
								Total Probable Construction Cost (Rounded)			**$ 8,700,000**	**$ 23,800,000**	

(1) For items without installation cost, installation cost is included in material price.
(2) Year 2012 dollars. Does not include engineering, administrative, and legal costs or contingency.

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN PREFERRED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

DRAFT

SPP 336 a&b
4/5/2012 (Unit costs in blue updated February 2022)

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Per Unit	Subtotal	Total Cost [2]	Total Cost [2]	Source of Unit Price
Satellite Storage (4.2 MG)											
Land Acquisition	Acres	2	$ 25,000	$ 50,000	$ 100,000	$ 200,000	$ -	$ -		$ 50,000	$ 200,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab) = $33,750; increased based on local experience, including consultant fees
Site Clearing	SF	26,017	$ 2	$ 52,033	$ 2.70	$ 70,245	$ -	$ -		$ 52,033	$ 70,245	see 2021 Unit Cost Backup tab
Excavation	CY	23,651	$ 40	$ 946,020	$ 40	$ 946,020	$ -	$ -		$ 946,020	$ 946,020	see 2021 Unit Cost Backup tab
Rock Excavation	CY	23,651			$ 200	$ 4,730,100					$ 4,730,100	assume half of excavation quantity will be rock; see 2021 Unit Cost Backup tab
Piles / Foundation	LS	1			$ 1,500,000	$ 1,500,000					$ 1,500,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Bedding	CY	1,349	$ 50	$ 67,450	$ 77	$ 103,873	$ -	$ -		$ 67,450	$ 103,873	see 2021 Unit Cost Backup tab
Concrete	CY	4,307	$ 1,000	$ 4,307,000	$ 1,200	$ 5,168,400	$ -	$ -		$ 4,307,000	$ 5,168,400	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 500,000	$ 500,000	$ 675,000	$ 675,000	$ 500,000	$ 675,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	40,710	$ 15	$ 610,650	$ 46	$ 1,872,660	$ -	$ -		$ 610,650	$ 1,872,660	see 2021 Unit Cost Backup tab
Backfill	CY	22,338	$ 10	$ 223,380	$ 44	$ 982,872	$ -	$ -		$ 223,380	$ 982,872	see 2021 Unit Cost Backup tab
Hauling	CY	24,963	$ 10	$ 249,630	$ 14	$ 337,001	$ -	$ -		$ 249,630	$ 337,001	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cleaning Equipment	LS	1	$ 95,000	$ 95,000	$ 128,250	$ 128,250	$ 47,500	$ 47,500	$ 64,125	$ 64,125	$ 142,500	$ 192,375	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Access Manholes	EA	3	$ 2,500	$ 7,500	$ 3,100	$ 9,300	$ -	$ -		$ 7,500	$ 9,300	see 2021 Unit Cost Backup tab
Miscellaneous Site Restoration	LS	1			$ 100,000	$ 100,000					$ 100,000	Based on local experience; to repair staging areas, misc. damage to site
Pavement Restoration	SF	9,000	$ 10	$ 90,000	$ 11	$ 99,000	$ -	$ -		$ 90,000	$ 99,000	see 2021 Unit Cost Backup tab
Grass Restoration	SY	1,891	$ 6	$ 11,344	$ 9	$ 17,017	$ -	$ -		$ 11,344	$ 17,017	see 2021 Unit Cost Backup tab
Satellite Storage Conveyance											
Excavation	CY	9,800	$ 40	$ 392,000	$ 40	$ 392,000	$ -	$ -		$ 392,000	$ 392,000	see 2021 Unit Cost Backup tab
Bedding	CY	1,958	$ 50	$ 97,900	$ 77	$ 150,766	$ -	$ -		$ 97,900	$ 150,766	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	75,600	$ 15	$ 1,134,000	$ 46	$ 3,477,600	$ -	$ -		$ 1,134,000	$ 3,477,600	see 2021 Unit Cost Backup tab
Backfill	CY	6,533	$ 20	$ 130,660	$ 44	$ 287,452	$ -	$ -		$ 130,660	$ 287,452	see 2021 Unit Cost Backup tab
Hauling	CY	3,267	$ 10	$ 32,670	$ 14	$ 44,105	$ -	$ -		$ 32,670	$ 44,105	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
5 ft Concrete Pipe	LF	1,800	$ 500	$ 900,000	$ 675	$ 1,215,000	$ -	$ -		$ 900,000	$ 1,215,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab). Requested cost from Forterra.
Cut Access into Main Interceptor	LS	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -		$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Manholes	EA	7	$ 2,500	$ 18,000	$ 3,100	$ 22,320	$ -	$ -		$ 18,000	$ 22,320	see 2021 Unit Cost Backup tab
Satellite Storage Force Main											
Excavation	CY	96	$ 40	$ 3,840	$ 40	$ 3,840	$ -	$ -		$ 3,840	$ 3,840	see 2021 Unit Cost Backup tab
Bedding	CY	33	$ 50	$ 1,650	$ 77	$ 2,541	$ -	$ -		$ 1,650	$ 2,541	see 2021 Unit Cost Backup tab
Backfill	CY	59	$ 10	$ 590	$ 44	$ 2,596	$ -	$ -		$ 590	$ 2,596	see 2021 Unit Cost Backup tab
Hauling	CY	37	$ 10	$ 370	$ 14	$ 500	$ -	$ -		$ 370	$ 500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cut Access into Main Interceptor	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -		$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pig Launcher	LS	1			$ 20,000	$ 20,000					$ 20,000	
4" ID Pipe	LF	100	$ 15	$ 1,500	$ 17	$ 1,650	$ -	$ -		$ 1,500	$ 1,650	see 2021 Unit Cost Backup tab
Satellite Storage Pump Station											
Pumps	EA	2	$ 40,000	$ 80,000	$ 65,000	$ 130,000	$ 20,000	$ 40,000	$ 27,000	$ 54,000	$ 120,000	$ 184,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab); vendor supplied pump cost
Pump Station Building	SF	100	$ 200	$ 20,000	$ 2,000	$ 200,000	$ -	$ -			$ 20,000	$ 200,000	based on Babcock PS RTC work
Piles / Foundation	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Piping in Tank (Including Bends)	LF	250	$ 150	$ 37,500	$ 203	$ 50,625	$ -	$ -			$ 37,500	$ 50,625	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Check Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Gate Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Wet Well Isolation Gates	EA	2	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 40,000	$ 54,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Misc Metals (Grating, Handrail, Monorails, Etc	LS	1	$ 50,000	$ 50,000	$ 150,000	$ 150,000	$ -	$ -			$ 50,000	$ 150,000	1.35 inflation markup = $67,500; use $150,000 based on Babcock PS RTC plus market increase; includes trash rack, hatches
Start-up and testing	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
												$ 23,605,856	
									Subtotal		**$ 10,400,000**	**$ 23,700,000**	
									Electrical, Controls and Instrumentation (15%)		**$ 1,600,000**	**$ 3,600,000**	
									Utility Relocation / Coordination (5%)			**$ 1,200,000**	
									MPT (5%)			**$ 1,200,000**	
									General Conditions, Bonds & Insurance (5% of Subtotal)		**$ 600,000**	**$ 1,500,000**	
									Total Probable Construction Cost (Rounded)		**$ 12,600,000**	**$ 31,200,000**	

(1) For items without installation cost, installation cost is included in material price.
(2) Year 2012 dollars. Does not include engineering, administrative, and legal costs or contingency.

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN PREFERRED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

DRAFT

SPP 337
4/5/2012 (Unit costs in blue updated February 2022)

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Material Per Unit	Material Subtotal	Installation (1) Per Unit	Installation (1) Subtotal	Installation (1) Per Unit	Installation (1) Subtotal	Total Cost (2)	Total Cost (2)	Source of Unit Price
Satellite Storage (0.7 MG)													
Land Acquisition	Acres	1	$ 25,000	$ 25,000	$ 500,000	$ 500,000	$ -	$ -			$ 25,000	$ 500,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab) = $33,750; increased based on local experience, including consultant fees
Site Clearing	SF	3,786	$ 2	$ 7,571	$ 2.70	$ 10,221	$ -	$ -			$ 7,571	$ 10,221	see 2021 Unit Cost Backup tab
Excavation	CY	5,787	$ 40	$ 231,480	$ 40	$ 231,480	$ -	$ -			$ 231,480	$ 231,480	see 2021 Unit Cost Backup tab
Rock Excavation	CY	5,787			$ 200	$ 1,157,400						$ 1,157,400	assume half of excavation quantity will be rock; see 2021 Unit Cost Backup tab
Piles / Foundation	LS	1			$ 500,000	$ 500,000						$ 500,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Bedding	CY	312	$ 50	$ 15,600	$ 77	$ 24,024	$ -	$ -			$ 15,600	$ 24,024	see 2021 Unit Cost Backup tab
Concrete	CY	1,218	$ 1,000	$ 1,218,000	$ 1,600	$ 1,948,800	$ -	$ -			$ 1,218,000	$ 1,948,800	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 500,000	$ 500,000	$ 675,000	$ 675,000	$ 500,000	$ 675,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	18,020	$ 15	$ 270,300	$ 46	$ 828,920	$ -	$ -			$ 270,300	$ 828,920	see 2021 Unit Cost Backup tab
Backfill	CY	6,889	$ 10	$ 68,890	$ 44	$ 303,116	$ -	$ -			$ 68,890	$ 303,116	see 2021 Unit Cost Backup tab
Hauling	CY	4,684	$ 10	$ 46,840	$ 14	$ 63,234	$ -	$ -			$ 46,840	$ 63,234	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cleaning Equipment	LS	1	$ 45,000	$ 45,000	$ 60,750	$ 60,750	$ 22,500	$ 22,500	$ 30,375	$ 30,375	$ 67,500	$ 91,125	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Access Manholes	EA	3	$ 2,500	$ 7,500	$ 3,100	$ 9,300	$ -	$ -			$ 7,500	$ 9,300	see 2021 Unit Cost Backup tab
Miscellaneous Site Restoration	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on local experience; to repair staging areas, misc. damage to site
Grass Restoration	SY	3,786	$ 6	$ 22,713	$ 9	$ 34,070	$ -	$ -			$ 22,713	$ 34,070	see 2021 Unit Cost Backup tab
Satellite Storage Conveyance													
Excavation	CY	179	$ 40	$ 7,160	$ 40	$ 7,160	$ -	$ -			$ 7,160	$ 7,160	see 2021 Unit Cost Backup tab
Bedding	CY	27	$ 50	$ 1,350	$ 77	$ 2,079	$ -	$ -			$ 1,350	$ 2,079	see 2021 Unit Cost Backup tab
Site Dewatering and Erosion Control	LS	1	$ -	$ -			$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Sheeting/Bracing	SF	1,484	$ 15	$ 22,260	$ 46	$ 68,264	$ -	$ -			$ 22,260	$ 68,264	see 2021 Unit Cost Backup tab
Backfill	CY	135	$ 10	$ 1,350	$ 44	$ 5,940	$ -	$ -			$ 1,350	$ 5,940	see 2021 Unit Cost Backup tab
Hauling	CY	44	$ 10	$ 440	$ 14	$ 594	$ -	$ -			$ 440	$ 594	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
4.5 ft Concrete Pipe	LF	28	$ 250	$ 7,000	$ 338	$ 9,450	$ -	$ -			$ 7,000	$ 9,450	1.35 inflation markup (see ENR 20 City Avg CCI Data tab). Requested cost from Forterra.
Cut Access into Main Interceptor	LS	1	$ 50,000	$ 50,000	$ 67,500	$ 67,500	$ -	$ -			$ 50,000	$ 67,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Manholes	EA	0	$ 2,500	$ -	$ 3,100	$ -	$ -	$ -			$ -	$ -	see 2021 Unit Cost Backup tab
Satellite Storage Force Main													
Excavation	CY	83	$ 40	$ 3,320	$ 40	$ 3,320	$ -	$ -			$ 3,320	$ 3,320	see 2021 Unit Cost Backup tab
Bedding	CY	27	$ 50	$ 1,350	$ 77	$ 2,079	$ -	$ -			$ 1,350	$ 2,079	see 2021 Unit Cost Backup tab
Backfill	CY	55	$ 10	$ 550	$ 44	$ 2,420	$ -	$ -			$ 550	$ 2,420	see 2021 Unit Cost Backup tab
Hauling	CY	28	$ 10	$ 280	$ 14	$ 378	$ -	$ -			$ 280	$ 378	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Cut Access into Main Interceptor	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Pig Launcher	LS	1			$ 20,000	$ 20,000						$ 20,000	
6" ID Pipe	LF	119	$ 30	$ 3,570	$ 23	$ 2,767	$ -	$ -			$ 3,570	$ 2,767	see 2021 Unit Cost Backup tab
Satellite Storage Pump Station													
Pumps	EA	2	$ 15,000	$ 30,000	$ 35,000	$ 70,000	$ 7,500	$ 15,000	$ 10,125	$ 20,250	$ 45,000	$ 90,250	1.35 inflation markup (see ENR 20 City Avg CCI Data tab); vendor supplied pump cost
Pump Station Building	SF	100	$ 200	$ 20,000	$ 2,000	$ 200,000	$ -	$ -			$ 20,000	$ 200,000	based on Babcock PS RTC work
Piles / Foundation	LS	1			$ 100,000	$ 100,000						$ 100,000	Based on JMD LeRoy WWTP 12/2021 estimates and CSO 026 Smith Street RTC
Piping in Tank (Including Bends)	LF	75	$ 150	$ 11,250	$ 203	$ 15,188	$ -	$ -			$ 11,250	$ 15,188	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Check Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Gate Valves	EA	2	$ 5,000	$ 10,000	$ 6,750	$ 13,500	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 30,000	$ 40,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Wet Well Isolation Gates	EA	2	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 10,000	$ 20,000	$ 13,500	$ 27,000	$ 40,000	$ 54,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Misc Metals (Grating, Handrail, Monorails, Etc	LS	1	$ 50,000	$ 50,000	$ 150,000	$ 150,000	$ -	$ -			$ 50,000	$ 150,000	1.35 inflation markup = $67,500; use $150,000 based on Babcock PS RTC plus market increase; includes trash rack, hatches
Start-up and testing	LS	1	$ 10,000	$ 10,000	$ 13,500	$ 13,500	$ -	$ -			$ 10,000	$ 13,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
												$ 7,453,578	
						Subtotal					**$ 2,900,000**	**$ 7,500,000**	
						Electrical, Controls and Instrumentation (15%)					**$ 400,000**	**$ 1,100,000**	
						Utility Relocation / Coordination (5%)						**$ 400,000**	
						MPT (5%)						**$ 400,000**	
						General Conditions, Bonds & Insurance (5% of Subtotal)					**$ 200,000**	**$ 500,000**	
						Legal Costs Associated with Private Land Acqusition and Restortation (10%)						**$ 60,000**	
						Total Probable Construction Cost (Rounded)					**$ 3,500,000**	**$ 10,000,000**	

(1) For items without installation cost, installation cost is included in material price.
(2) Year 2012 dollars. Does not include engineering, administrative, and legal costs or contingency.

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN PREFERRED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

DRAFT

Northern Interceptor Improvements

4/5/2012 (Unit costs in blue updated February 2022)

Description	Material						Installation [1]				Total Cost [2]	Total Cost [2]	Source of Unit Price
	Basis	No. Units	Per Unit	Subtotal	Per Unit	Subtotal	Per Unit	Subtotal	Per Unit	Subtotal			
Satellite Storage (2.6 MG)													
TBM Excavation	LS	1	$ 3,790,000	$ 3,790,000	$ 5,116,500	$ 5,116,500	$ -	$ -			$ 3,790,000	$ 5,116,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Shafts	EA	4	$ 1,262,500	$ 5,050,000	$ 1,704,375	$ 6,817,500	$ -	$ -			$ 5,050,000	$ 6,817,500	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
TBM Concrete Lining	LF	6,000	$ 1,250	$ 7,500,000	$ 1,688	$ 10,125,000	$ -	$ -			$ 7,500,000	$ 10,125,000	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
Site Setup	LS	1	$ 5,025,000	$ 5,025,000	$ 6,783,750	$ 6,783,750	$ -	$ -			$ 5,025,000	$ 6,783,750	1.35 inflation markup (see ENR 20 City Avg CCI Data tab)
												$ 28,842,750	
								Subtotal			**$ 21,400,000**	**$ 28,900,000**	
								Indirect Cost (40%)			**$ 8,600,000**	**$ 11,600,000**	
								OH&P (20%)			**$ 6,000,000**	**$ 8,100,000**	
								Total Probable Construction Cost (Rounded)			**$ 36,000,000**	**$ 48,600,000**	see updated cost below

(1) For items without installation cost, installation cost is included in material price.

(2) Year 2012 dollars. Does not include engineering, administrative, and legal costs or contingency.

(3) Costs provided by Kiewet Construction

Attachment C

PROJECTS CONSIDERED FOR OPTIMIZATION

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Table C.1 Projects Considered for Optimization

Tag	Project	Project Type	Included in the Original 2014 LTCP (Y/N)	Proposed to be Included in Updated LTCP (Y/N)	Most Impacted CSO	Most Impacted SPP	Most Impacted Water Body	Reduction in Activations of Most Impacted CSO (v3.4.0-ltcp vs. 2020 LTCP Model) *	Current Estimated Capital Cost**	Current Estimated Present Worth of Operations & Maintenance Costs**	Current Estimated Total Present Worth Cost**	Proposed Engineering Start	Proposed Construction Completion
CSO006_1	Jefferson Ferry RTC	RTC	N	N	006	179	Black Rock Canal	N/A	N/A	N/A	N/A	N/A	N/A
CSO006_2	Gates Circle RTC	RTC	N	Y	006	179	Black Rock Canal	14	$ 2,835,287	$ 1,292,820	$ 4,128,107	Mar 2022	May 2026
CSO006_3	Delavan Drain Weir Raising & RTC	RTC	N	Y	006	179	Black Rock Canal	14	$ 4,000,000	$ 1,292,820	$ 5,292,820	Sep 2029	Apr 2034
CSO006_5	20% GI Implementation	GI	Y	Y	006	331	Black Rock Canal	14	$ 10,506,000	$ 2,560,043	$ 13,066,043	Sep 2030	Mar 2035
CSO010_1	Breckenridge Niagara RTC	RTC	N	Y	010	021	Black Rock Canal	0	$ 3,636,617	$ 1,292,820	$ 4,929,437	Mar 2022	Feb 2027
CSO011_1.1	20% GI Implementation	GI	Y	Y	011	024	Niagara River	1	$ 3,982,000	$ 970,378	$ 4,952,378	Sep 2031	Feb 2036
CSO011_1.2	SPP024 Modification	SPP Modification	Y	Y	011	024	Niagara River	1	$ 60,000	$ 115,380	$ 175,380	Sep 2025	Nov 2027
CSO012_1.1	Albany Plymouth ILS	RTC	N	N	012	023	Black Rock Canal	N/A	N/A	N/A	N/A	N/A	N/A
CSO012_1.2	SPP023 Modification	SPP Modification	Y	Y	012	023	Black Rock Canal	-3	$ 60,000	$ 115,380	$ 175,380	Sep 2025	Nov 2027
CSO012_2.1	SPP296 Modification	SPP Modification	Y	Y	012	296	Black Rock Canal	-3	$ 60,000	$ 115,380	$ 175,380	Sep 2025	Nov 2027
CSO012_2.2	Albany Tunnel ILS West	RTC	N	N	012	296	Black Rock Canal	N/A	N/A	N/A	N/A	N/A	N/A
CSO012_2.3	Albany Tunnel ILS East	RTC	N	N	012	296	Black Rock Canal	N/A	N/A	N/A	N/A	N/A	N/A
CSO012_2.4	Baynes Relief Sewer	Diversion	N	N	012	023	Black Rock Canal	N/A	N/A	N/A	N/A	N/A	N/A
CSO012_2.5	Norwood Relief Sewer	Diversion	N	N	012	296	Black Rock Canal	N/A	N/A	N/A	N/A	N/A	N/A
CSO013_1	SPP304 Modification	SPP Modification	N	Y	013	304	Black Rock Canal	-4	$ 60,000	$ 115,380	$ 175,380	Sep 2025	Nov 2027
CSO014_1.1	SPP206A&B RTC	RTC	N	Y	014	206A&B	Erie Basin Marina	0	$ 4,000,000	$ 1,292,820	$ 5,292,820	Sep 2024	Feb 2028
CSO014_1.2	Erie Basin Marina OLS	OLS	Y	Y	014	206A&B	Erie Basin Marina	0	$ 62,440,000	$ 6,575,770	$ 69,015,770	Sep 2025	Mar 2032
CSO017_1.1	SPP054 Sewer Separation	Sewer Separation	N	Y	017	Mill Race ILS	Buffalo River	8	$ 700,000	$ 422,000	$ 1,122,000	Sep 2032	Jun 2036
CSO017_1.2	594 Exchange OLS	OLS	N	N	017	Mill Race ILS	Buffalo River	N/A	N/A	N/A	N/A	N/A	N/A

*v3.4.0-ltcp includes all projects in Selected Alternative, therefore the reduction in activations for the most impacted CSO could be influenced by multiple projects. A negative reduction indicates an increase in activations, but the total number of activations is within the maximum target number for every water body in v3.4.0-ltcp.
**Detailed cost estimates were not developed for projects that are not in the Selected Alternative

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Table C.1 Projects Considered for Optimization

Tag	Project	Project Type	Included in the Original 2014 LTCP (Y/N)	Proposed to be Included in Updated LTCP (Y/N)	Most Impacted CSO	Most Impacted SPP	Most Impacted Water Body	Reduction in Activations of Most Impacted CSO (v3.4.0-ltcp vs. 2020 LTCP Model) *	Current Estimated Capital Cost**	Current Estimated Present Worth of Operations & Maintenance Costs**	Current Estimated Total Present Worth Cost**	Proposed Engineering Start	Proposed Construction Completion
CSO017_10	SPP051 modification	SPP Modification	N	Y	017	051	Buffalo River	8	$ 60,000	$ 115,380	$ 175,380	Sep 2028	Nov 2030
CSO017_4	20% GI Implementation	GI	Y	Y	017	326	Buffalo River	8	$ 7,490,000	$ 1,828,602	$ 9,318,602	Sep 2031	Feb 2036
CSO017_6	Bass Alley & Emslie St. OLS	OLS	N	Y	017	Mill Race ILS	Buffalo River	8	$ 32,620,000	$ 5,096,160	$ 37,716,160	Sep 2030	Mar 2037
CSO017_7	Mill Race OLS	OLS	N	N	017	Mill Race ILS	Buffalo River	N/A	N/A	N/A	N/A	N/A	N/A
CSO017_8	SPP326 modification	SPP Modification	N	Y	017	326	Buffalo River	8	$ 60,000	$ 115,380	$ 175,380	Sep 2025	Nov 2027
CSO017_9	SPP059 modification	SPP Modification	N	Y	017	059	Buffalo River	8	$ 60,000	$ 115,380	$ 175,380	Sep 2028	Nov 2030
CSO026_1.1	Gibson ILS	RTC	Y	N	026	Smith Street ILS	Buffalo River	N/A	N/A	N/A	N/A	N/A	N/A
CSO026_1.2	Lord St./Tyler Likos Park OLS	OLS	N	N	026	Smith Street ILS	Buffalo River	N/A	N/A	N/A	N/A	N/A	N/A
CSO026_1.3	Collins Park OLS	OLS	N	Y	026	Smith Street ILS	Buffalo River	1	$ 30,100,000	$ 2,871,770	$ 32,971,770	Sep 2026	May 2033
CSO026_1.4	S4246 (Eagle) OLS	OLS	N	N	026	Smith Street ILS	Buffalo River	N/A	N/A	N/A	N/A	N/A	N/A
CSO026_4	20% GI Implementation	GI	Y	Y	026	Smith Street ILS	Buffalo River	1	$ 25,104,000	$ 6,119,721	$ 31,223,721	Sep 2032	Mar 2037
CSO027_1	SPP 317 modification	SPP Modification	N	Y	027	097	Buffalo River	7	$ 60,000	$ 115,380	$ 175,380	Sep 2026	Nov 2028
CSO027_2	Babcock PS Weir Modification	SPP Modification	N	Y	027	097	Buffalo River	7	$ 60,000	$ 115,380	$ 175,380	Sep 2026	Apr 2029
CSO027_3	SPP97 modification	SPP Modification	N	Y	027	097	Buffalo River	7	$ 60,000	$ 115,380	$ 175,380	Sep 2028	Nov 2030
CSO027_4	SPP067 modification	SPP Modification	N	N	027	097	Buffalo River	N/A	N/A	N/A	N/A	N/A	N/A
CSO028_1	Hopkins & Osage OLS	OLS	Y	Y	028	123A	Buffalo River	0	$ 17,640,000	$ 5,097,750	$ 22,737,750	Sep 2030	Mar 2037
CSO029_1.2	Re-route to Hopkins & Osage OLS	OLS	N	N	029	126	Buffalo River	N/A	N/A	N/A	N/A	N/A	N/A
CSO033_1	Bailey & Regent OLS (Moreland Park)	OLS	N	Y	033	104	Buffalo River	13	$ 53,620,000	$ 6,517,920	$ 60,137,920	Sep 2031	Mar 2038
CSO033_2	Clinton St OLS	OLS	N	Y	033	104	Buffalo River	13	$ 163,800,000	$ 4,653,580	$ 168,453,580	Sep 2028	Mar 2034

*v3.4.0-ltcp includes all projects in Selected Alternative, therefore the reduction in activations for the most impacted CSO could be influenced by multiple projects. A negative reduction indicates an increase in activations, but the total number of activations is within the maximum target number for every water body in v3.4.0-ltcp.
**Detailed cost estimates were not developed for projects that are not in the Selected Alternative

Table C.1 Projects Considered for Optimization

Tag	Project	Project Type	Included in the Original 2014 LTCP (Y/N)	Proposed to be Included in Updated LTCP (Y/N)	Most Impacted CSO	Most Impacted SPP	Most Impacted Water Body	Reduction in Activations of Most Impacted CSO (v3.4.0-ltcp vs. 2020 LTCP Model) *	Current Estimated Capital Cost**	Current Estimated Present Worth of Operations & Maintenance Costs**	Current Estimated Total Present Worth Cost**	Proposed Engineering Start	Proposed Construction Completion
CSO033_3	SPP104 modification	SPP Modification	N	Y	033	104	Buffalo River	13	$ 60,000	$ 115,380	$ 175,380	Sep 2028	Nov 2030
CSO037_1	Morgan Road OLS	OLS	N	N	037	122	Cazenovia Creek - C	N/A	N/A	N/A	N/A	N/A	N/A
CSO053_1.4	SPP336B OLS (Sidney OLS)	OLS	N	Y	053	336B	Scajaquada Creek	22	$ 27,720,000	$ 3,214,370	$ 30,934,370	Sep 2023	May 2030
CSO053_1.5	Schiller Park OLS SPP336B Modification	SPP Modification	N	Y	053	336B	Scajaquada Creek	22	$ 60,000	$ 115,380	$ 175,380	Sep 2023	Nov 2025
CSO053_10	SPP229A (Jefferson Florida) RTC	RTC	N	Y	053	229A	Scajaquada Creek	22	$ 3,000,000	$ 115,380	$ 3,115,380	Mar 2022	Jul 2024
CSO053_11	Canisius OLS	OLS	Y	Y	053	333	Scajaquada Creek	22	$ 30,000,000	$ 2,824,460	$ 32,824,460	Dec 2021	Apr 2029
CSO053_12.1	Jefferson Ave GI	GI	Y	Y	053	333	Scajaquada Creek	22	$ 460,000	$ 112,154	$ 572,154	Mar 2022	Jun 2026
CSO053_12.2	Jefferson Ave GI	GI	Y	Y	053	229A	Scajaquada Creek	22	$ 1,520,000	$ 368,159	$ 1,888,159	Mar 2022	Jun 2026
CSO053_13	SPP165B Modification	SPP Modification	N	Y	053	165B	Scajaquada Creek	22	$ 60,000	$ 115,380	$ 175,380	Sep 2023	Nov 2025
CSO053_14	SPP175 Modification	SPP Modification	N	Y	053	179	Scajaquada Creek	22	$ 60,000	$ 115,380	$ 175,380	Sep 2023	Nov 2025
CSO053_2.1	Colorado DUC	DUC	N	N	053	337	Scajaquada Creek	N/A	N/A	N/A	N/A	N/A	N/A
CSO053_2.2	Delavan & Moselle OLS	OLS	N	N	053	337	Scajaquada Creek	N/A	N/A	N/A	N/A	N/A	N/A
CSO053_2.4	William Gaiter Relief Sewer to Amherst Quarry	Diversion	N	N	053	337	Scajaquada Creek	N/A	N/A	N/A	N/A	N/A	N/A
CSO053_2.5	SPP337 Modification	SPP Modification	N	Y	053	337	Scajaquada Creek	22	$ 60,000	$ 115,380	$ 175,380	Sep 2023	Nov 2025
CSO053_3.1	SPP338 Modification	SPP Modification	N	Y	053	338	Scajaquada Creek	22	$ 4,000,000	$ 1,292,820	$ 5,292,820	Sep 2023	Jun 2028
CSO053_3.2	Amherst & Bailey RTC	RTC	Y	Y	053	338	Scajaquada Creek	22	$ 2,150,872	$ 1,292,820	$ 3,443,692	Dec 2021	Jul 2026
CSO053_3.3	Bailey & Minnesota SPP254 Modification	SPP Modification	N	Y	053	338	Scajaquada Creek	22	$ 232,385	$ 115,380	$ 347,765	Mar 2022	Jul 2024

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**Detailed cost estimates were not developed for projects that are not in the Selected Alternative

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Table C.1 Projects Considered for Optimization

Tag	Project	Project Type	Included in the Original 2014 LTCP (Y/N)	Proposed to be Included in Updated LTCP (Y/N)	Most Impacted CSO	Most Impacted SPP	Most Impacted Water Body	Reduction in Activations of Most Impacted CSO (v3.4.0-ltcp vs. 2020 LTCP Model) *	Current Estimated Capital Cost**	Current Estimated Present Worth of Operations & Maintenance Costs**	Current Estimated Total Present Worth Cost**	Proposed Engineering Start	Proposed Construction Completion
CSO053_3.4	Kensington & Poultney RTC	RTC	N	N	053	338	Scajaquada Creek	N/A	N/A	N/A	N/A	N/A	N/A
CSO053_5.1	Lang Weber OLS	OLS	N	N	053	340	Scajaquada Creek	N/A	N/A	N/A	N/A	N/A	N/A
CSO053_5.2	Edison Martha OLS	OLS	N	Y	053	340	Scajaquada Creek	22	$ 37,240,000	$ 3,243,860	$ 40,483,860	Sep 2023	May 2031
CSO053_8	SPP341A Modification	SPP Modification	Y	Y	053	341A	Scajaquada Creek	22	$ 60,000	$ 115,380	$ 175,380	Sep 2023	Nov 2025
CSO053_9	20% GI Implementation	GI	Y	Y	053	341A	Scajaquada Creek	22	$ 3,344,000	$ 814,337	$ 4,158,337	Sep 2027	Dec 2031
CSO055_1.1	Hertel at Delaware ILS/Hertel North East	RTC	Y	Y	055	001	Niagara River	5	$ 4,000,000	$ 1,292,820	$ 5,292,820	Sep 2033	Jun 2038
CSO055_1.2	Military Road ILS	RTC	N	N	055	001	Niagara River	N/A	N/A	N/A	N/A	N/A	N/A
CSO055_1.5	Military Rd OLS	OLS	Y	Y	055	001	Niagara River	5	$ 96,880,000	$ 5,934,920	$ 102,814,920	Feb 2027	Jan 2035
CSO055_1.6	Shoshone Park OLS	OLS	N	N	055	001	Niagara River	N/A	N/A	N/A	N/A	N/A	N/A
CSO055_3	20% GI Implementation	GI	Y	Y	055	001	Niagara River	5	$ 52,032,000	$ 12,678,306	$ 64,710,306	Sep 2033	Mar 2038
CSO064_1.1	CSO064 ILS	ILS	N	Y	064	137	Buffalo River	2	$ 4,000,000	$ 1,292,820	$ 5,292,820	Sep 2029	Mar 2033
CSO064_1.2	SPP 137 Modification	SPP Modification	N	Y	064	137	Buffalo River	2	$ 60,000	$ 115,380	$ 175,380	Sep 2029	Nov 2031
CSO064_2	Perry Street Sanitary Sewer	Sewer Separation	N	Y	064	137	Buffalo River	2	$ 4,800,000	$ 492,120	$ 5,292,120	Sep 2032	Jun 2036
CSO064_3	SPP133 modification	SPP Modification	N	N	064	133	Buffalo River	N/A	N/A	N/A	N/A	N/A	N/A
System_1	Northern Relief Tunnel	Tunnel	Y	Y	011	024	Niagara River	1	$ 72,810,744	$ 2,471,480	$ 75,282,224	Feb 2027	Jun 2038
System_2	Schiller Park OLS	OLS	N	Y	053	341A	Scajaquada Creek	22	$ 85,960,000	$ 4,379,800	$ 90,339,800	Sep 2024	May 2031
System_2_3	Schiller Park OLS SPP339 Modification	SPP Modification	N	Y	053	339	Scajaquada Creek	22	$ 60,000	$ 115,380	$ 175,380	Sep 2024	Nov 2026
System_2_4	Schiller Park OLS SPP340 Modification	SPP Modification	N	Y	053	340	Scajaquada Creek	22	$ 60,000	$ 115,380	$ 175,380	Sep 2024	Apr 2027

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Table C.1 Projects Considered for Optimization

Tag	Project	Project Type	Included in the Original 2014 LTCP (Y/N)	Proposed to be Included in Updated LTCP (Y/N)	Most Impacted CSO	Most Impacted SPP	Most Impacted Water Body	Reduction in Activations of Most Impacted CSO (v3.4.0-ltcp vs. 2020 LTCP Model) *	Current Estimated Capital Cost**	Current Estimated Present Worth of Operations & Maintenance Costs**	Current Estimated Total Present Worth Cost**	Proposed Engineering Start	Proposed Construction Completion
System_5	Hamburg PS RTC	RTC	N	N	064	137	Buffalo River	N/A	N/A	N/A	N/A	N/A	N/A
System_6	Mineral Springs Rd RTC/OLS	RTC	N	N	017	326	Buffalo River	N/A	N/A	N/A	N/A	N/A	N/A
System_7	Southern Relief Tunnel	Tunnel	N	N	011	024	Niagara River	N/A	N/A	N/A	N/A	N/A	N/A
System_8	Swan Trunk Relief Tunnel	Tunnel	N	N	011	024	Niagara River	N/A	N/A	N/A	N/A	N/A	N/A

*v3.4.0-ltcp includes all projects in Selected Alternative, therefore the reduction in activations for the most impacted CSO could be influenced by multiple projects. A negative reduction indicates an increase in activations, but the total number of activations is within the maximum target number for every water body in v3.4.0-ltcp.
**Detailed cost estimates were not developed for projects that are not in the Selected Alternative

Note:
1. X+1 Volume is the estimated volume required to meet the required level of control at a sewer patrol point..

SPP001 X + 1 Volume = 21.41 MGal
Military Road ILS
Military Rd OLS
20% GI Implementation
Hertel at Delaware ILS/Hertel North East
Shoshone Park OLS
Bailey & Minnesota SPP254 Modification
Amherst & Bailey RTC
Kensington & Poultney RTC
Edison Martha OLS
William Gaiter Relief Sewer to Amherst Quarry
SPP021 X + 1 Volume = 0.72 MGal
Delavan Drain Weir Raising & RTC
SPP231 X + 1 Volume = 0.25 MGal
CSO006 20% GI Implementation
SPP180 X + 1 Volume = 0.23 MGal
SPP179 X + 1 Volume = 1.02 MGal
Jefferson Ave GI
Canisius OLS
Gates Circle RTC
SPP229A (Jefferson Florida) RTC
SPP165B X + 1 Volume = 0.16 MGal
SPP165B Modification
Delavan & Moselle OLS
Lang Weber OLS
Breckenridge Niagara RTC
SPP204 X + 1 Volume = 0.14 MGal
Schiller Park OLS SPP336B Modification
SPP336B OLS (Sidney OLS)
SPP337 Modification
Colorado DUC
SPP338 Modification
20% GI Implementation
Baynes Relief Sewer
Norwood Relief Sewer
Jefferson Ferry RTC
Jefferson Ave GI
SPP336B X + 1 Volume = 6.18 MGal
SPP337 X + 1 Volume = 1.93 MGal
Schiller Park OLS SPP339 Modification
SPP341A Modification
SPP024 X + 1 Volume = 7.27 MGal
SPP023 X + 1 Volume = 0.61 MGal
SPP024 Modification
SPP023 Modification
Albany Tunnel ILS East
Albany Plymouth ILS
Schiller Park OLS
SPP341A X + 1 Volume = 0.86 MGal
SPP175 Modification
SPP175 X + 1 Volume = 0.13 MGal
SPP304 Modification
20% GI Implementation
SPP206A X + 1 Volume = 0.84 MGal
SPP206A&B ILS Optimization/206 A&B RTC
SPP206B X + 1 Volume = 0.84 MGal
20% GI Implementation
Gibson ILS
Bailey & Regent OLS (Moreland Park)
SPP326 X + 1 Volume = 1.1 MGal
SPP326 modification
Swan Trunk Relief Tunnel
SPP055 X + 1 Volume = 0.4 MGal
20% GI Implementation
Babcock PS Weir Modification
SPP051 modification
SPP059 X + 1 Volume = 0.17 MGal
Lord St./Tyler Likos Park OLS
SPP 317 modification
SPP054 Sewer Separation
S4246 (Eagle) OLS
SPP067 modification
SPP133 modification
594 Exchange OLS
Mill Race OLS
Collins Park OLS
Clinton St OLS
Southern Relief Tunnel
CSO064 ILS
SPP 137 Modification
SPP137 X + 1 Volume = 0.17 MGal
SPP104 modification
SPP097 X + 1 Volume = 1.63 MGal
SPP97 modification
SPP104 X + 1 Volume = 3.47 MGal
SPP126 X + 1 Volume = 0.2 MGal
Mineral Springs Rd RTC/OLS
SPP122 X + 1 Volume = 0.3 MGal
Hopkins & Osage OLS
Re-route to Hopkins & Osage OLS
SPP123A X + 1 Volume = 0.74 MGal
Morgan Road OLS

Legend

- Projects Under Consideration
- Sewer Patrol Point
- ≤0.158 MGal
- Out of Compliance Sewer Patrol Points
- ≤21.4 MGal

Paper Size ARCH D

0 2,000 4,000 6,000

Feet

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD83 New York West ftUS

N

xylem Let's Solve Water

ARCADIS

GHD

BUFFALO SEWER AUTHORITY
WET WEATHER OPERATIONS OPTIMIZATION
LTCP OPTIMIZATION SELECTED ALTERNATIVE

PROJECTS UNDER CONSIDERATION

Project No. **11225567**
Date **10/11/2022**

FIGURE 1

\\ghdnet\ghd\US\Harrisburg\General\MDT Services\Service Groups\Spatial Service Group\GIS\11225567\GIS\Maps\Working\11225567 BSA LTCP Projects.aprx - RTC Projects Under Consideration

Attachment D

SELECTED ALTERNATIVE PROJECT DETAILS

Note:
1. X+1 Volume is the estimated volume required to meet the required level of control at a sewer patrol point..

SPP001
X + 1 Volume
+ 21.41 MGal

Military Rd OLS

20% GI Implementation

Hertel at Delaware ILS/Hertel North East

Bailey & Minnesota SPP254 Modification

Amherst & Bailey RTC

Edison Martha OLS

SPP021
X + 1 Volume
+ 0.72 MGal

SPP024
X + 1 Volume
+ 7.27 MGal

Delavan Drain Weir Raising & RTC

SPP331
X + 1 Volume
+ 0.25 MGal

CSO006 20% GI Implementation

SPP180
X + 1 Volume
+ 0.23 MGal

SPP170
X + 1 Volume
+ 1.02 MGal

Jefferson Ave GI

SPP165B
X + 1 Volume
+ 0.16 MGal

SPP165B Modification

SPP229A (Jefferson Florida) RTC

Canisius OLS

Gates Circle RTC

SPP336B OLS (Sidney OLS)

SPP229A
X + 1 Volume
+ 0.14 MGal

Jefferson Ave GI

Schiller Park OLS SPP336B Modification

SPP338
X + 1 Volume
+ 2.32 MGal

SPP337 Modification

SPP338 Modification

20% GI Implementation

SPP341A Modification

Schiller Park OLS SPP339 Modification

SPP337
X + 1 Volume
+ 1.93 MGal

SPP340
X + 1 Volume
+ 3.05 MGal

Schiller Park OLS

Breckenridge Niagara RTC

SPP024 Modification

SPP023 Modification

SPP236
X + 1 Volume
+ 2.94 MGal

SPP023
X + 1 Volume
+ 0.61 MGal

SPP175 Modification

SPP175
X + 1 Volume
+ 0.13 MGal

SPP304 Modification

20% GI Implementation

SPP206A
X + 1 Volume
+ 0.84 MGal

SPP206A&B ILS Optimization/206 A&B RTC

SPP206B
X + 1 Volume
+ 0.84 MGal

Bailey & Regent OLS (Moreland Park)

20% GI Implementation

SPP326 modification

SPP326
X + 1 Volume
+ 1.1 MGal

SPP051 modification

SPP059 modification

Bass Alley & Emslie St. OLS

20% GI Implementation

Babcock PS Weir Modification

SPP 317 modification

SPP054 Sewer Separation

Perry Street Sanitary Sewer

SPP059
X + 1 Volume
+ 0.17 MGal

SPP067
X + 1 Volume
+ 4.19 MGal

Collins Park OLS

Clinton St OLS

CSO064 ILS

SPP 137 Modification

SPP137
X + 1 Volume
+ 0.17 MGal

SPP104 modification

SPP104
X + 1 Volume
+ 3.47 MGal

SPP97
X + 1 Volume
+ 1.63 MGal

SPP97 modification

SPP126
X + 1 Volume
+ 0.2 MGal

SPP122
X + 1 Volume
+ 0.3 MGal

Hopkins & Osage OLS

SPP123A
X + 1 Volume
+ 0.74 MGal

Legend

- Initial Alternative for LTCP Optimization
- Sewer Patrol Point
- ≤0.158 MGal
- Out of Compliance Sewer Patrol Points
- ≤21.4 MGal

Paper Size ARCH D

0 2,000 4,000 6,000

Feet

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD83 New York West ftUS

N

xylem Let's Solve Water

ARCADIS

GHD

BUFFALO SEWER AUTHORITY
WET WEATHER OPERATIONS OPTIMIZATION
LTCP OPTIMIZATION SELECTED ALTERNATIVE

SELECTED PROJECTS

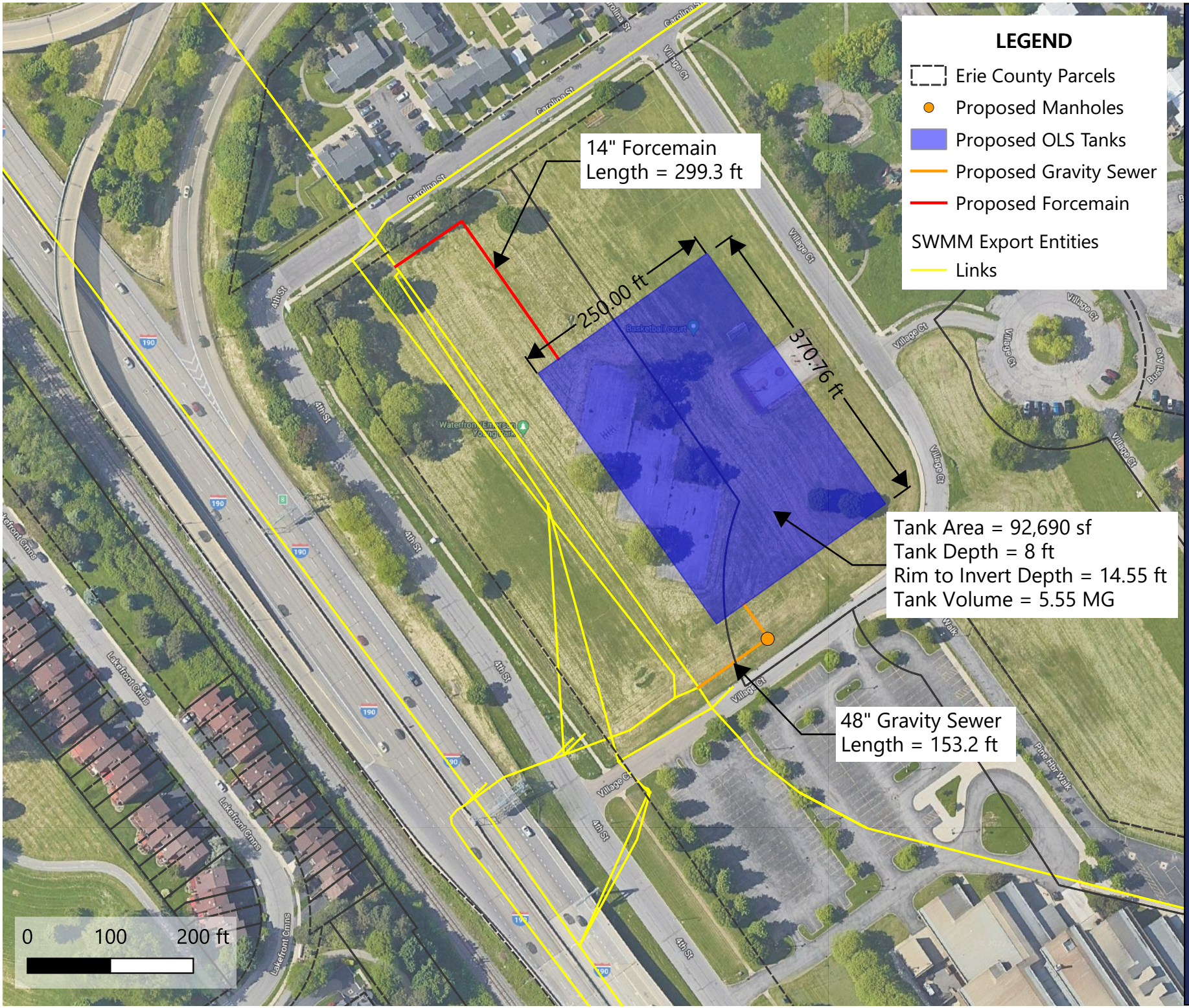
Project No. **11225567**
Date **10/12/2022**

FIGURE 2

\\ghdnet\ghd\US\Harrisburg\General\MDT Services\Service Groups\Spatial Service Group\GIS\11225567\GIS\Maps\Working\11225567 BSA LTCP Projects.aprx - Initial LTCP Projects

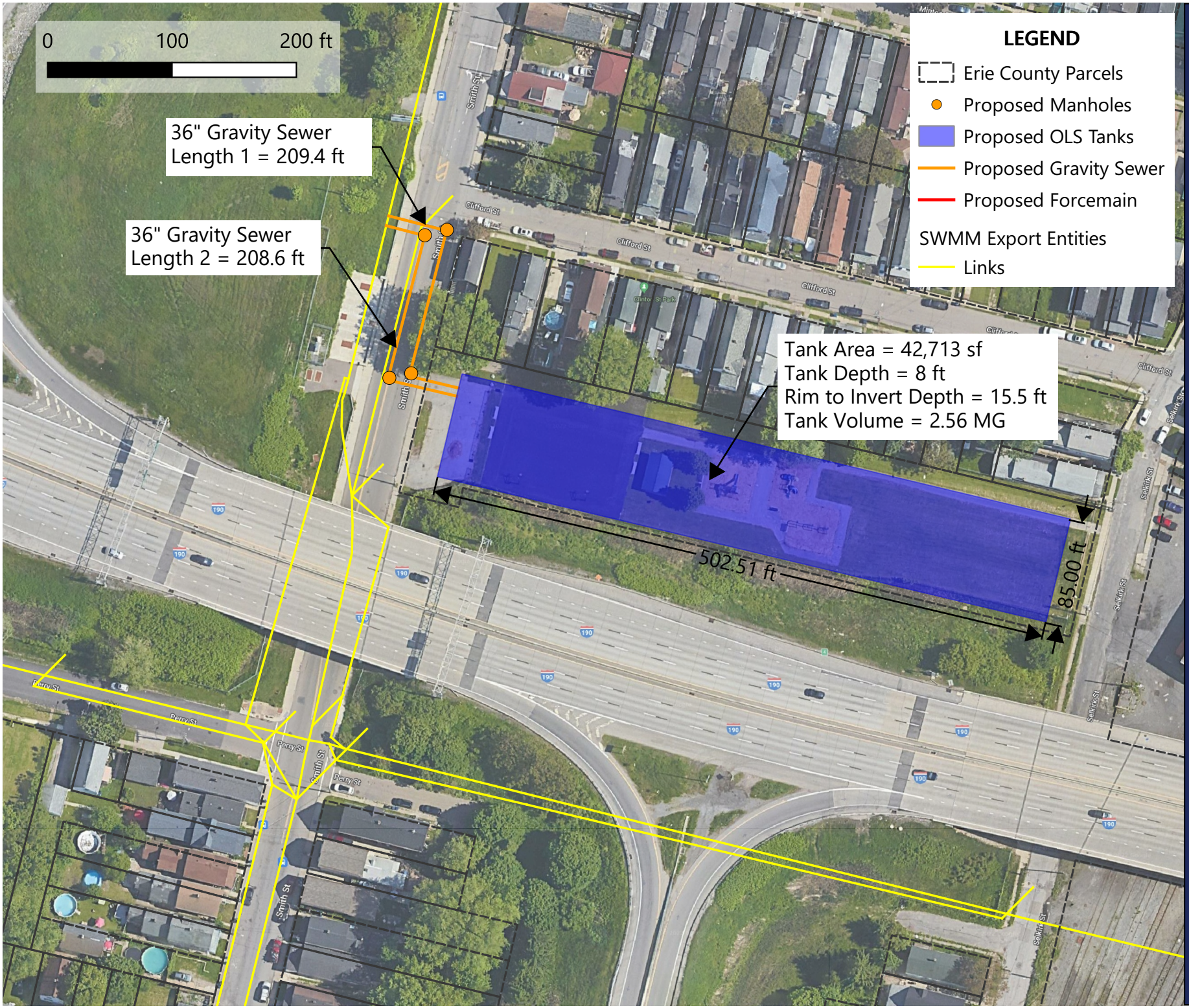
Table D.1
Preliminary Design Considerations for Proposed Off-Line Storage (OLS) Tanks

OLS Tank	Advantages of Base Configuration	Disadvantages of Base Configuration	Key Considerations
CSO014_1.2 Erie Basin Marina OLS	• Adequate room for tank construction and vehicle access • Location provides an opportunity to improve existing park land	• Environmental remediation possibly needed at site	• Considerable construction savings possible by re-configuring tank to be deeper with a smaller footprint
CSO026_1.3 Collins Park OLS	• Can dewater by gravity • No bedrock present • Location provides an opportunity to improve existing park land	• Close to the I-190 and utilities that run adjacent to the thruway; would involve NYSTA coordination at minimum • Adjacent to a residential neighborhood	• Expensive to build shallow tank, but adding pumping may be more complex solution than is needed for this area
CSO028_1 Hopkins & Osage OLS	• Adequate room for tank construction and vehicle access • Location provides an opportunity to improve existing park land	• Adjacent to a residential neighborhood and force main will traverse a residential street	• Some construction savings possible by configuring tank to be deeper with a smaller footprint
CSO033_1 Bailey & Regent OLS		• Tight space for construction access, staging, and ramp into excavation • Can excavate without ramp, but construction costs would increase • Adjacent to a residential neighborhood and police station	• A deeper tank with a smaller footprint is recommended • A shaft configuration may be worth consideration
CSO033_2 Clinton St OLS RTC	• Can dewater by gravity • Adequate room for construction access • Acceptable buffer between west side of tank and homes • Location provides an opportunity to improve existing park land	• Extensive formwork will be required for tank installation, especially the roof slab	• Considerable construction savings possible by re-configuring tank to be deeper with a smaller footprint and utilize pumped dewatering
CSO053_1.4 SPP336B OLS	• Can dewater by gravity	• Adjacent to a residential neighborhood and tank footprint close to existing structures • Likely need to close Lark Street next to site for construction access purposes • Tight space for construction	• Can add approximately 10’ tank depth and still dewater by gravity to Scajaquada Tunnel • Land on east side of Lark Street could be considered for contractor staging
CSO053_5.2 Edison Martha OLS	• Can dewater by gravity • West side of site could be used for construction access • Location provides an opportunity to improve existing park land	• Adjacent to a school, which may require additional coordination and scheduling constraints	• Long side of tank could be oriented east-west instead of north-south on property • Could be dewatered toward Suffolk, west of tank (SPP 339) • Tank could also be moved further west, away from the school and closer to Roosevelt and Martha Avenues
CSO055_1.5 Military Rd OLS	• Adequate room for construction access	• Adjacent to a school and will consume footprint of school parking lot, which may require additional coordination and scheduling constraints • Work zone traffic control for tank inlet and outlet piping may be challenging on Military Road and Hertel Avenue	• A deeper tank with a smaller footprint is worth further consideration
System_2 Schiller Park OLS	• Good separation from existing structures • Can dewater by gravity • Location provides an opportunity to improve existing park land	• Adjacent to a residential neighborhood	• Considerable construction savings possible by configuring tank to be deeper with a smaller footprint and utilize pumped dewatering
CSO017_6 Bass Alley OLS	• Circular shaft design will fit the available space better than a rectangular structure	• Adjacent to a residential neighborhood and existing homes and structures are relatively close to tank • Railroad coordination and permit may be required	• 20’ deeper tank would reduce diameter by about half; would improve construction access and may reduce construction cost



BUFFALO SEWER AUTHORITY
LONG TERM CONTROL PLAN OPTIMIZATION

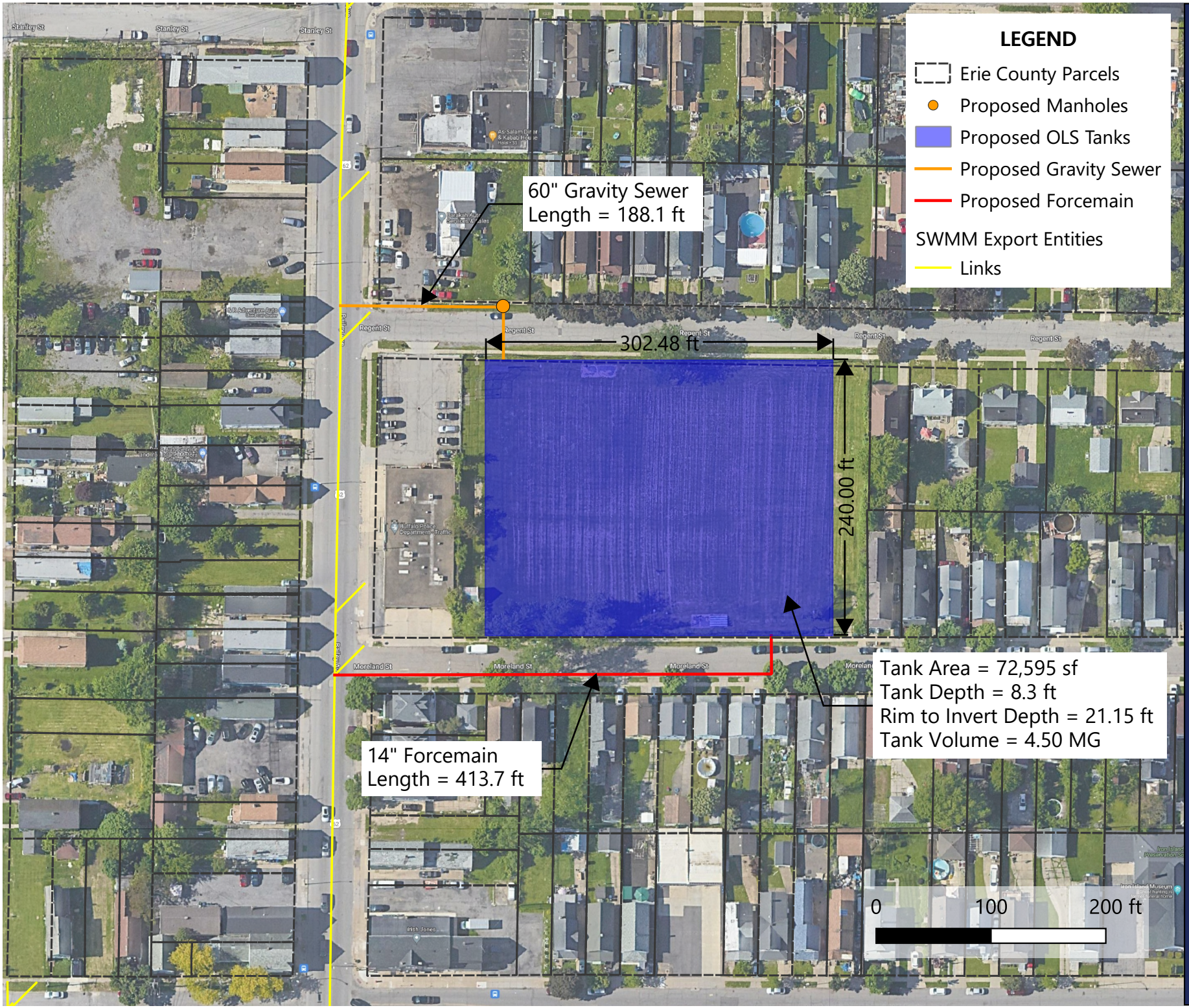
CSO014_1.2 ERIE BASIN MARINA OLS



BUFFALO SEWER AUTHORITY
LONG TERM CONTROL PLAN OPTIMIZATION

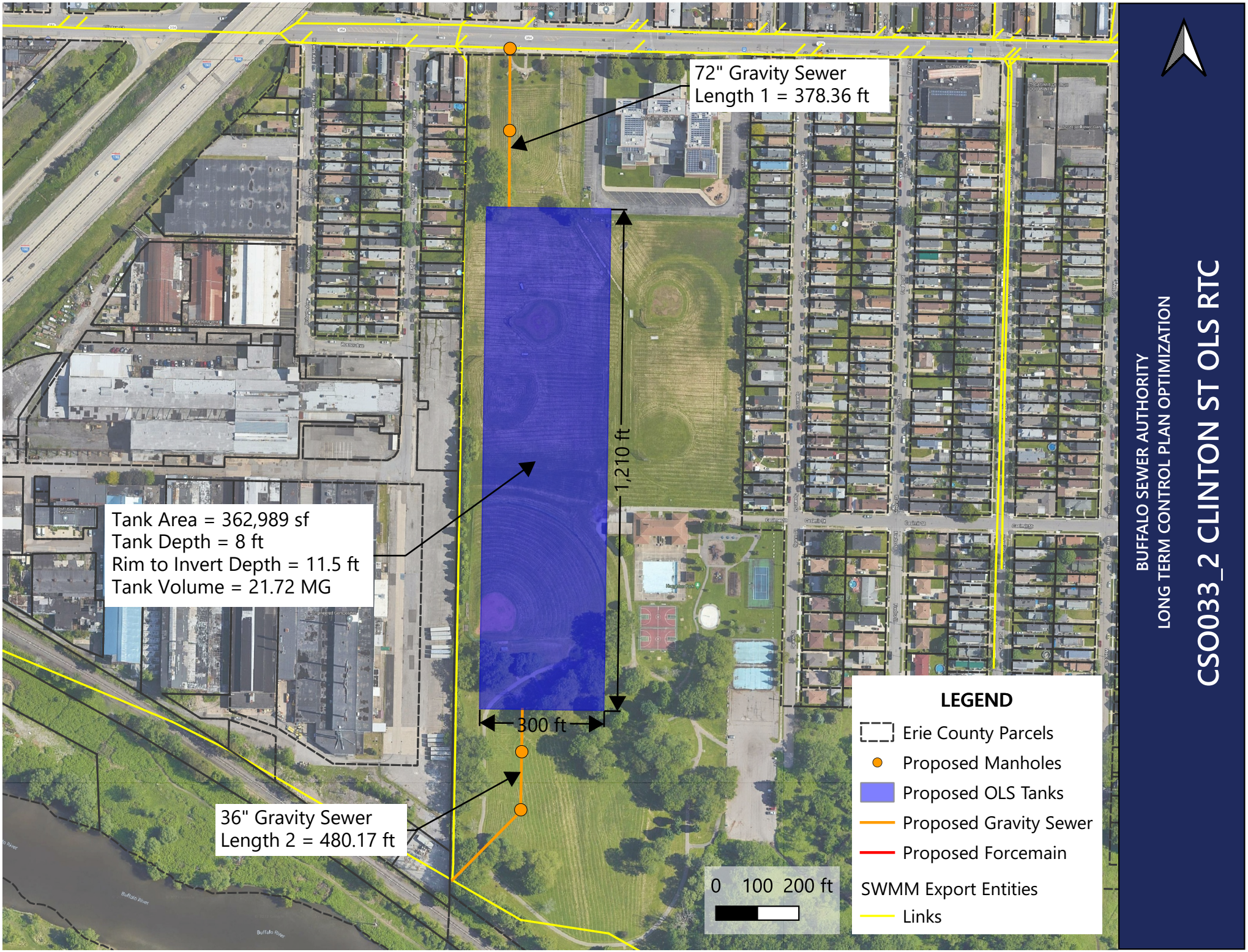
CSO026_1.3 COLLINS PARK OLS

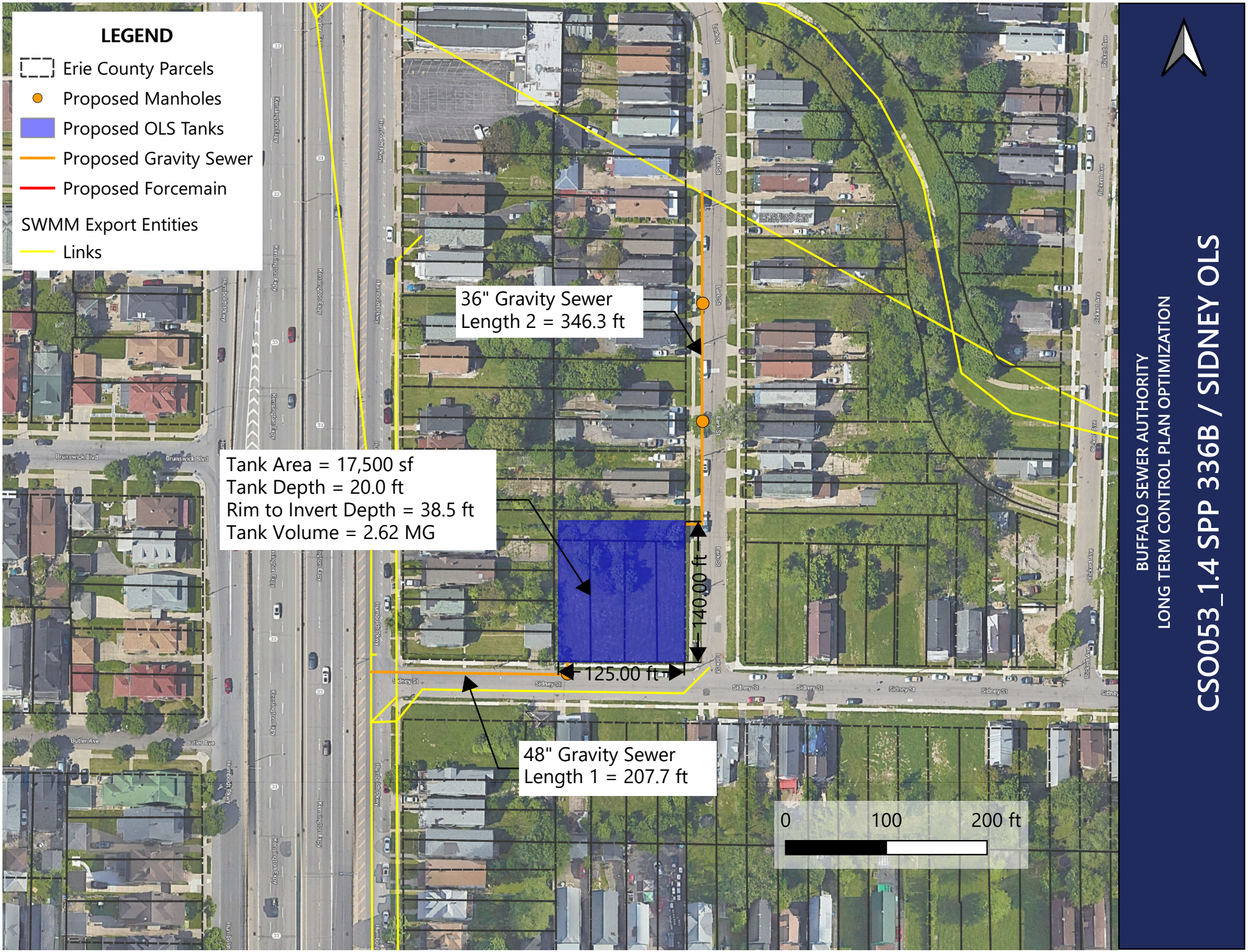

6" Forcemain
Length = 1123.9 ft
36" Gravity Sewer
Length = 342.1 ft
149.42 ft
85.00 ft
Tank Area = 12,701 sf
Tank Depth = 10 ft
Rim to Invert Depth = 21.06 ft
Tank Volume = 0.95 MG
LEGEND
Erie County Parcels
Proposed Manholes
Proposed OLS Tanks
Proposed Gravity Sewer
Proposed Forcemain
SWMM Export Entities
Links
0
100
200 ft
BUFFALO SEWER AUTHORITY
LONG TERM CONTROL PLAN OPTIMIZATION
CSO028_1 HOPKINS & OSAGE



BUFFALO SEWER AUTHORITY
LONG TERM CONTROL PLAN OPTIMIZATION

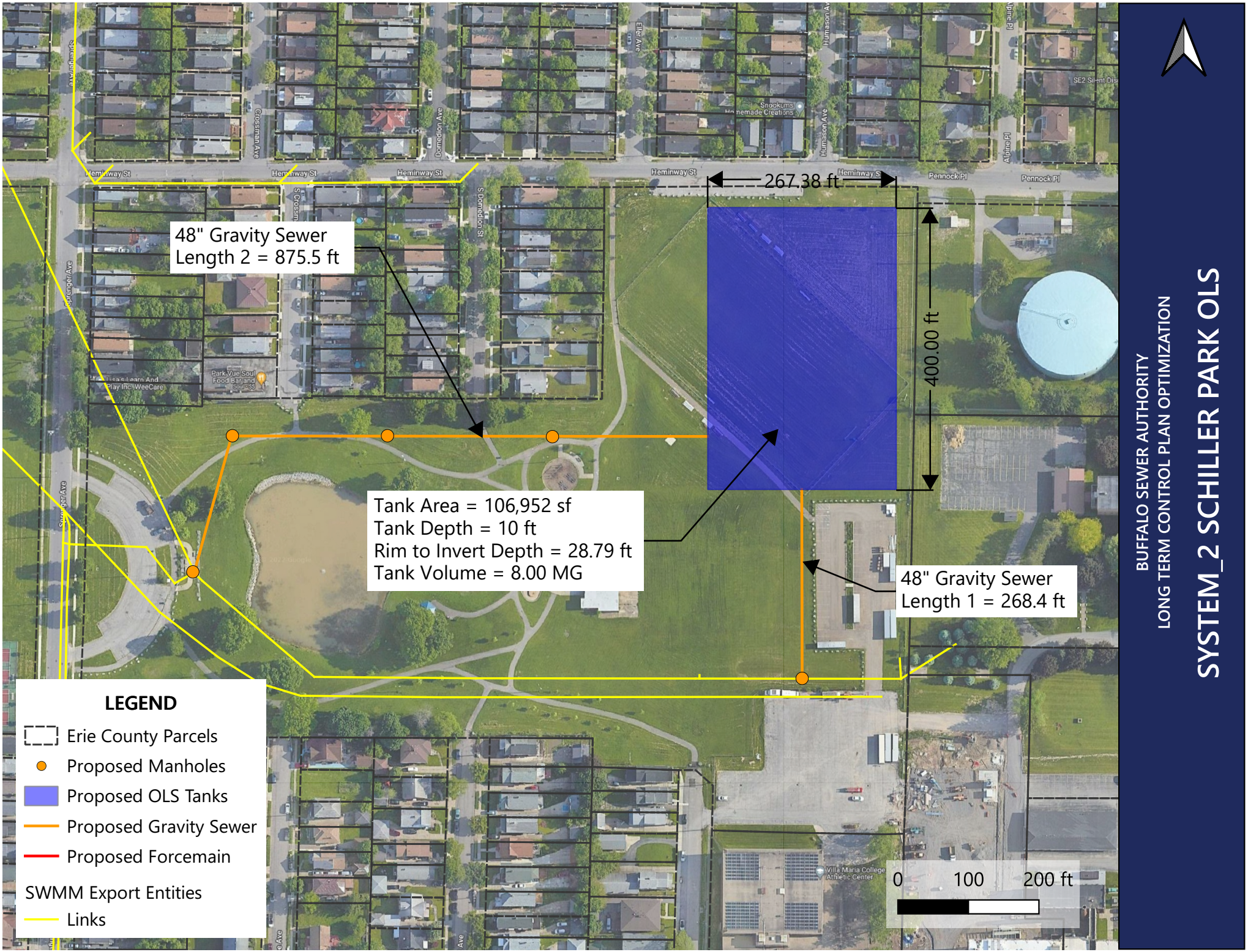
CSO033_1 BAILEY & REGENT OLS

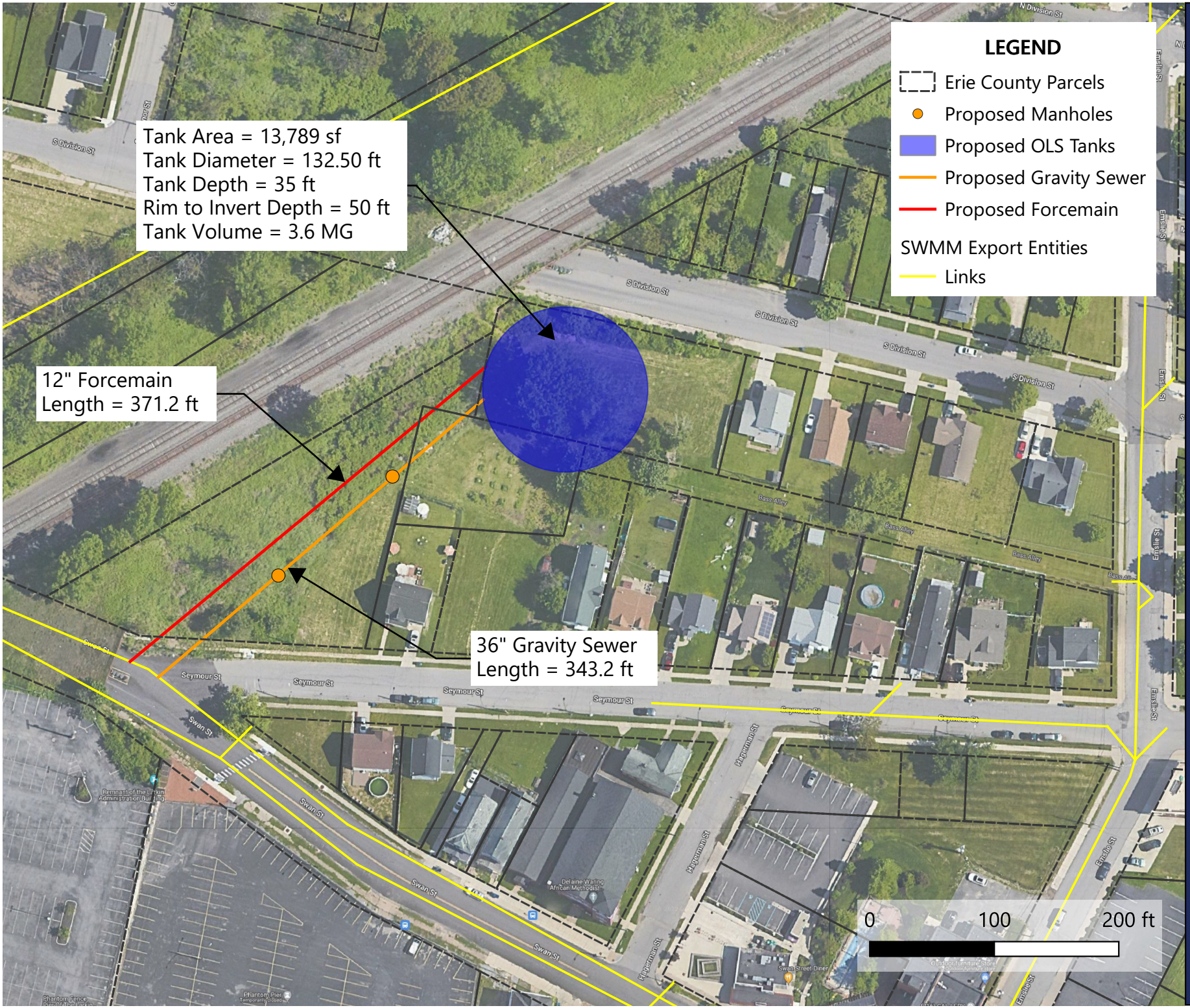

72" Gravity Sewer
Length 1 = 378.36 ft
Tank Area = 362,989 sf
Tank Depth = 8 ft
Rim to Invert Depth = 11.5 ft
Tank Volume = 21.72 MG
1,210 ft
300 ft
36" Gravity Sewer
Length 2 = 480.17 ft
0 100 200 ft
LEGEND
Erie County Parcels
Proposed Manholes
Proposed OLS Tanks
Proposed Gravity Sewer
Proposed Forcemain
SWMM Export Entities
Links
BUFFALO SEWER AUTHORITY
LONG TERM CONTROL PLAN OPTIMIZATION
CSO033_2 CLINTON ST OLS RTC

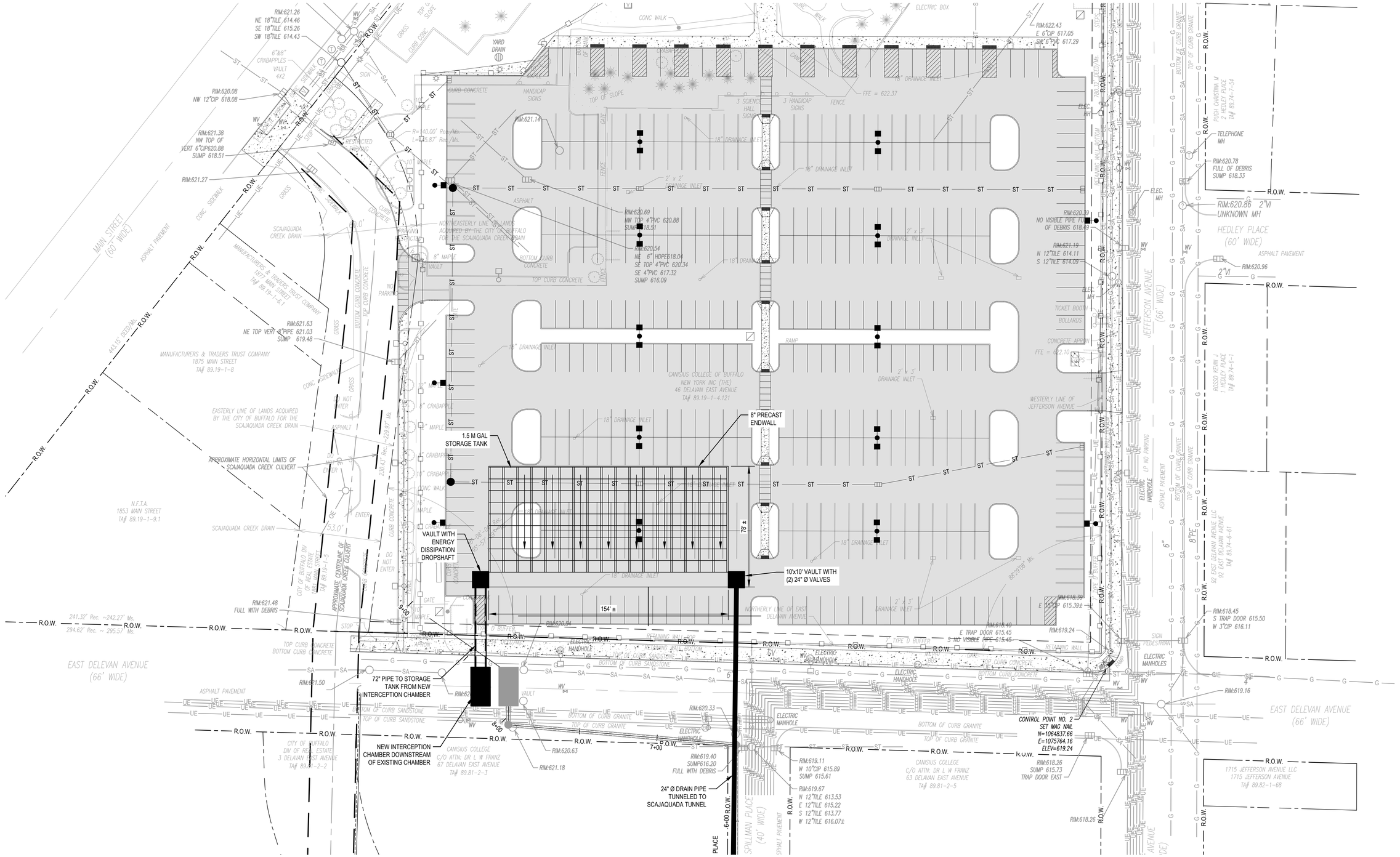

LEGEND
Erie County Parcels
Proposed Manholes
Proposed OLS Tanks
Proposed Gravity Sewer
Proposed Forcemain
SWMM Export Entities
Links
36" Gravity Sewer
Length 2 = 346.3 ft
Tank Area = 17,500 sf
Tank Depth = 20.0 ft
Rim to Invert Depth = 38.5 ft
Tank Volume = 2.62 MG
140.00 ft
125.00 ft
48" Gravity Sewer
Length 1 = 207.7 ft
0
100
200 ft
BUFFALO SEWER AUTHORITY
LONG TERM CONTROL PLAN OPTIMIZATION
CSO053_1.4 SPP 336B / SIDNEY OLS


LEGEND
Erie County Parcels
Proposed Manholes
Proposed OLS Tanks
Proposed Gravity Sewer
Proposed Forcemain
SWMM Export Entities
Links
48" Gravity Sewer
Length 1 = 401.9 ft
Tank Area = 43,667 sf
Tank Depth = 8 ft
Rim to Invert Depth = 22.2 ft
Tank Volume = 2.61 MG
335.90 ft
130.00 ft
24" Gravity Sewer
Length 2 = 327.9 ft
BUFFALO SEWER AUTHORITY
LONG TERM CONTROL PLAN OPTIMIZATION
CSO053_5.2 EDISON MARTHA OLS


7' Gravity Sewer
Length = 660.43 ft
Tank Area = 77,206 sf
Tank Depth = 20 ft
Rim to Invert Depth = 42.95 ft
Tank Volume = 11.55 MG
200.00 ft
386.03 ft
20" Forcemain
Length = 805.74 ft
0
100
200 ft
LEGEND
Erie County Parcels
Proposed Manholes
Proposed OLS Tanks
Proposed Gravity Sewer
Proposed Forcemain
SWMM Export Entities
Links
BUFFALO SEWER AUTHORITY
LONG TERM CONTROL PLAN OPTIMIZATION
CSO055_1.5 MILITARY RD OLS


267.38 ft
400.00 ft
48" Gravity Sewer
Length 2 = 875.5 ft
Tank Area = 106,952 sf
Tank Depth = 10 ft
Rim to Invert Depth = 28.79 ft
Tank Volume = 8.00 MG
48" Gravity Sewer
Length 1 = 268.4 ft
LEGEND
Erie County Parcels
Proposed Manholes
Proposed OLS Tanks
Proposed Gravity Sewer
Proposed Forcemain
SWMM Export Entities
Links
0
100
200 ft
BUFFALO SEWER AUTHORITY
LONG TERM CONTROL PLAN OPTIMIZATION
SYSTEM_2 SCHILLER PARK OLS


Tank Area = 13,789 sf
Tank Diameter = 132.50 ft
Tank Depth = 35 ft
Rim to Invert Depth = 50 ft
Tank Volume = 3.6 MG
12" Forcemain
Length = 371.2 ft
36" Gravity Sewer
Length = 343.2 ft
LEGEND
Erie County Parcels
Proposed Manholes
Proposed OLS Tanks
Proposed Gravity Sewer
Proposed Forcemain
SWMM Export Entities
Links
0
100
200 ft
BUFFALO SEWER AUTHORITY
LONG TERM CONTROL PLAN OPTIMIZATION
CSO017_6 BASS ALLEY OLS



NOTES:

1. TOTAL CUT VOLUME: 16,083 CU YDS
2. EXCAVATION SET TO AN ELEVATION OF 7.10' WITH OUTER LIMITS BEING SET TO 4' OUTSIDE OF 1.5 MILLION GALLON ALTERNATIVE CONCRETE STRUCTURE OPTION.

N

0 30' 60'

GHD

BUFFALO SEWER AUTHORITY
JEFFERSON STORAGE TANK

JEFFERSON STORAGE TANK 1.5 MIL GAL PRECAST CONCRETE STRUCTURE ALTERNATIVE - SOUTH

Project No. **12569825**
Report No. **001**
Date **MARCH 2022**

FIGURE 4

Filename: \\AMH-SVR-001\Projects$\564\12569825\Digital_Design\ACAD 2020\Sheets\Figures\Report 001\12569825-Figure 4.dwg
Plot Date: 10 March 2022 - 11:06 AM

Table D.2
Design Updates for Projects in 2014 LTCP Preferred Alternative

2014 LTCP Preferred Alternative Project		Design Updates in Selected Alternative	Considerations Leading to Design Update
CSO 013 (0.3 MG)		Replaced with SPP304 Modification (CSO013_1)	SPP modification is more cost effective than OLS to address small out of compliance activations in final version of Selected Alternative.
CSO 014/015 (0.8 MG)		Updated to larger tank: 5.55 MG Erie Basin Marina OLS (CSO14_1.2)	1. Remaining out of compliance activations for SPP206A&B were larger than original CSO014/015 tank size 2. ECSD inflow update increase the number of activations at SPP206A&B 3. Additional OLS at this location helps reduce overflows at other SPPs that are influenced by the Swan Trunk level such as SPP024 and SPP097
CSO 028/044/047 (2.3 MG)		Updated to smaller tank: 0.95 MG Hopkins & Osage OLS (CSO028_1)	Preliminary model results showed storage was no longer needed to achieve compliance for CSO-044 and CSO-047
CSO 052 (0.6 MG)		Removed	Deemed to no longer be necessary when running the updated PC-SWMM model using the typical year rainfall because downstream SPP was in compliance.
CSO 055 (7.5 MG)		Updated to larger tank with new location: 11.55 MG Military Rd OLS (CSO055_1.5)	1. Remaining out of compliance activations for SPP001 were larger than original CSO055 tank size 2. ECSD inflow update increased the number of activations and total overflow volume at SPP001 3. New location selected to avoid land acquisition issues Note: Implementation and size of CSO055_1.5 is dependent on outcome of detailed design evaluation for Northern Relief Tunnel
CSO 064 (0.1 MG)		Replaced with CSO064 ILS (CSO064_1.1)	Replaced with more efficient/constructable project to ensure that BSA achieves the water quality goals of the Administrative Order within the anticipated schedule.
Jefferson & Florida (SPP 170B) (2.6 MG)		Replaced by SPP229A/Jefferson Florida RTC (CSO053_10) and 1.5 MG Canisius/Jefferson Delavan OLS (CSO053_11)	New opportunity to move the tank location North and utilize an existing parking garage area at Jefferson and Delavan proposed to be demolished for the construction of a new surface parking lot.
SPP 336 a/b (SPP165A, SPP165B, SPP 336A, SPP336B) (4.2 MG)		Replaced by SPP165B Modification (CSO053_13), 3.26 MG SPP336B Sidney Street OLS (CSO053_1.4), and SPP336B Modification (CSO053_1.5)	1. SPP165A and SPP336A were in compliance in preliminary model results 2. Opportunity to coordinate when to send flows to Scajaquada Tunnel with new projects such as Schiller Park OLS
SPP 337 (0.7 MG)		Replaced by SPP337 Modification (CSO053_2.5)	Replaced with more efficient/constructable project to ensure that BSA achieves the water quality goals of the Administrative Order within the anticipated schedule.
North Relief Sewer		New configuration, tagged as Northern Relief Tunnel (System_1)	Updated configuration with information gathered in more detailed tunnel route evaluation than original LTCP
Underflow Upsizing (CSO 008/010, 061, 004)		Replaced by Breckenridge Niagara RTC (CSO010_1)	Target activations are already met in the baseline model at CSO-008 and CSO-061, so the project only needs to address activations at CSO-010
Revised Foundation Plan	Additional SPP Optimizations	Removed SPP019 Underflow Upsizing, SPP330 Underflow Upsizing, SPP336A Underflow Upsizing. Replaced with multiple SPP Modification projects for SPPs that were out of compliance.	Some SPP Underflow Upsizing projects deemed to no longer be necessary when running the updated PC-SWMM model using the typical year rainfall because their downstream SPPs were in compliance.
	Real Time Control (RTC)	Updated RTC projects based on RTC Re-evaluation and added dynamic control to projects that did not include RTC prior.	1. Some RTC project locations were deemed to be infeasible due to shallow sewers/low-lying connections, contaminated soils, high traffic, etc. 2. Implemented globally coordinated control strategy to optimize performance of existing RTC sites 3. Implemented dynamic control at OLS facilities to optimize the timing of storage and dewatering for maximum CSO reduction
	Hamburg Drain Storage (5 MG)	Replaced by Mill Race RTC and 3.6 MG Bass Alley OLS (CSO017_6)	Replaced with more efficient/constructable projects to ensure that BSA achieves the water quality goals of the Administrative Order within the anticipated schedule.
	Smith Street Storage (0.5 MG)	Updated to larger tank: 2.56 MG Collins Park OLS (CSO026_1.3)	Remaining out of compliance activations for Smith St ILS were larger than original Smith St tank size
	CSO-016 Storage (0.06 MG)	Removed	CSO-016 had no activations in preliminary model testing
Green Infrastructure	Total controlled acreage – 1,315 acres	Updated total controlled acreage for future projects to 522 acres	1. Updated model with GI that has already been implemented 2. Only added GI to control 20% of impervious area upstream of SPPs that were out of compliance in baseline model

Attachment E

SWMM RESULTS

Table E.1 Model Definitions

Model Name	Description
New Model Baseline Condition	2014 Conditions Model (equivalent to Revised Baseline in the 2014 LTCP Report) for the Updated Model
Old Model Baseline Condition	2014 Conditions Model (equivalent to Revised Baseline in the 2014 LTCP Report) for the Old Model (Model available during development of the 2014 LTCP)
New Model Scheduled Projects 3/18/2022	Includes projects scheduled to be completed by 3/18/2022 in the 2014 LTCP (Updated Model)
Old Model Scheduled Projects 3/18/2022	Includes projects scheduled to be completed by 3/18/2022 in the 2014 LTCP (Old Model)
New Model Actual Work 3/18/2022	Includes projects actually completed by 3/18/2022 (Updated Model)
New Model LTCP Completion	Includes all LTCP projects from the 2014 LTCP (Updated Model)
Old Model LTCP Completion	Includes all LTCP projects from the 2014 LTCP (Old Model)
2020 LTCP Model	Updated Model with projects completed to date and remaining 2014 LTCP plan projects (not including CSO-052 Off-Line Storage, SPP019 Underflow Upsizing, SPP330 Underflow Upsizing, and SPP336A Underflow Upsizing), referred to as “LTCP baseline projects model” or the “baseline plan”.
Selected Alternative (v3.4.0-ltcp_1b0f735)	Updated model with projects completed to data and selected project set from optimization process

Notes
1. The Quarry is not a CSO, but rather a temporary storage basin that was proposed to be utilized more extensively in the approved LTCP to prevent CSO discharges to Scajaquada Creek and the Black Rock Canal.
2. CSO 003 was listed as discharging to the Niagara River in the original model because it discharges downstream of the Black Rock Canal lock, however it does discharge to the artificial channel of the Black Rock Canal rather than the Niagara River, so it has been reallocated to this waterway
3. The SPPs used for calculating overflow volume have changed between model scenarios due to infrastructure changes in real life and/or the SWMM model, use key below when reviewing SPP overflow volumes in Table E.3

Cell Format Key	
	Upstream of a consolidated SPP structure such as Smith St ILS
N/A	SPP overflow volume not tracked for model scenario
	Upstream of the Proposed Mill Race ILS (Hamburg Drain Storage in original LTCP)
	Upstream of the Smith Street ILS/OLS in Original 2014 LTCP
	Upstream of the CSO 028 OLS structure in Original 2014 LTCP

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Table E.2 Typical Year Simulation Results by CSO

CSO	In Original Model	Receiving Water	New Model Baseline Condition		Old Model Baseline Condition		New Model Scheduled Projects 3/18/2022		Old Model Scheduled Projects 3/18/2022		New Model Actual Work 3/18/2022		New Model LTCP Completion		Old Model LTCP Completion		2020 LTCP Model		Selected Alternative (v3.4.0-ltcp_1b0f735)	
			Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations
003	Yes	Black Rock Canal	0.78	4	0.11	6	1.52	4	0	0	1.55	4	1.55	3	0.8	5	1.34	3	2.15	4
004	Yes	Black Rock Canal	4.51	5	11.25	5	5.92	5	0	0	6.2	4	9.8	5	8.7	3	9.41	6	3.92	2
005	Yes	Black Rock Canal	0.00	0	0.08	4	0	0	0	0	0	0	0	0	0.1	4	0	0	0	0
006	Yes	Black Rock Canal	91.52	47	198.92	65	21.91	15	4.19	10	21.93	15	16.53	15	21.7	4	16.46	15	1.01	1
007	No	Black Rock Canal	0.37	2	0.00	0	0.37	2	0	0	0.32	2	0.32	2	0	0	0.32	2	0.31	2
008	Yes	Black Rock Canal	11.71	33	6.11	39	11.72	33	1.28	5	0	0	0	0	0	0	0	0	0	0
009	No	Black Rock Canal	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
010	Yes	Black Rock Canal	8.15	14	11.85	44	8.15	14	0.28	2	8.11	14	0	0	0	1	0	0	0	0
011	Yes	Niagara River	286.46	39	134.29	41	220.65	35	52.53	16	222.33	35	15.61	5	11.7	4	13.76	5	22.49	4
012	Yes	Black Rock Canal	58.34	35	52.48	42	58.09	35	6.97	7	58.26	35	0	0	0.9	2	0	0	1.05	3
013	Yes	Black Rock Canal	4.06	4	6.75	7	3.91	4	0	0	3.9	4	0	0	2.7	4	0	0	2.57	4
014	Yes	Erie Basin Marina	28.34	12	4.19	4	18.06	10	0.18	1	17.8	10	6.37	2	3.1	2	5.86	2	5.71	2
015	Yes	Erie Basin Marina	0.00	0	6.14	12	0	0	0	0	0	0	0	0	0.6	1	0	0	0	0
016	Yes	Erie Basin Marina	0.00	0	0.00	0	0	0	0.26	2	0	0	0	0	0	0	0	0	0	0
017	Yes	Buffalo River	131.83	24	71.26	49	127.79	21	17.07	5	129.06	21	65.72	10	34.8	4	65.21	12	37.84	4
022	Yes	Buffalo River	1.48	6	29.79	49	1.47	6	4.82	16	1.47	6	1.47	6	2	5	1.45	6	0.4	2
023	No	Buffalo River	0.28	2	0.00	0	0.28	2	0	0	0.28	2	0.28	2	0	0	0.28	2	0.26	2
025	Yes	Buffalo River	1.38	4	1.44	11	1.38	4	0.68	3	1.38	4	1.38	4	1.2	6	1.37	4	1.53	4
026	Yes	Buffalo River	77.99	9	124.16	63	70.93	8	121.33	65	70.5	8	54.94	8	29.6	3	53.29	7	46.14	6
027	Yes	Buffalo River	50.67	10	31.67	36	68.42	11	21.33	3	68.59	12	100.25	11	39.1	6	71.37	11	42.15	4
028	Yes	Buffalo River	19.95	33	45.54	69	19.95	33	23.18	29	19.95	33	0.2	1	22.7	6	3.54	4	3.23	4
029	Yes	Buffalo River	2.98	4	0.00	0	3.08	4	0	0	3.08	4	4.74	6	0	0	11.16	12	3.35	4
031	No	Cazenovia Creek - C	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
032	Yes	Buffalo River	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
033	Yes	Buffalo River	88.33	15	37.77	9	92.91	15	26.11	5	94.61	15	91.21	15	31.8	5	77.58	15	2.58	2
035	Yes	Cazenovia Creek - B	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
037	Yes	Cazenovia Creek - C	12.18	10	23.30	13	8.25	6	9.3	6	8.18	5	6.7	5	11.9	6	10.07	9	7.65	5
038	No	Cazenovia Creek - C	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
039	Yes	Cazenovia Creek - C	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
040	No	Cazenovia Creek - C	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
042	No	Cazenovia Creek - C	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
044	Yes	Cazenovia Creek - C	0.47	2	2.32	7	1.1	3	2.22	4	1.21	3	1.05	3	0.7	2	0.53	2	1.02	3
046	Yes	Cazenovia Creek - C	0.00	0	1.31	1	0	0	0	0	0	0	0	0	1.3	0	0	0	0	0
047	Yes	Cazenovia Creek - C	1.66	4	8.65	44	1.86	5	0	0	1.86	5	1.86	5	1.5	3	1.62	4	1.88	5
048	Yes	Cazenovia Creek - C	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
049	Yes	Buffalo River	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
050	Yes	Buffalo River	1.57	5	3.17	14	1.54	5	2.42	5	1.55	5	1.55	5	2.8	5	1.44	4	1.54	5
051	Yes	Buffalo River	0.00	0	1.22	4	0	0	1	3	0	0	0	0	1.2	4	0	0	0	0
052	Yes	Buffalo River	0.00	0	10.87	10	0	0	8.92	6	0	0	0	0	6.3	3	0	0	0	0
053	Yes	Scajaquada Creek	330.11	37	268.00	65	291.32	37	82.19	24	300.84	37	177.25	26	52.1	4	179.84	26	27.05	4
054	Yes	Niagara River	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
055	Yes	Cornelius Creek	722.15	38	601.09	41	621.12	31	169.61	15	632.99	33	425.86	16	206.2	9	401.54	14	320.8	9
056	Yes	Scajaquada Creek	0.00	0	0.04	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0
057	Yes	Scajaquada Creek	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
058	Yes	Scajaquada Creek	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
059	Yes	Scajaquada Creek	4.13	12	0.00	0	0.11	1	0.58	2	0.11	1	0.11	1	0	0	0.11	1	0.1	1
060	Yes	Scajaquada Creek	0.00	0	0.70	5	0	0	3.48	19	0	0	0	0	0	0	0	0	0	0
061	Yes	Black Rock Canal	0.00	0	31.19	10	0	0	0	0	0	0	0	0	1.2	2	0	0	9.44	2
062	No	Black Rock Canal	0.00	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
063	Yes	Black Rock Canal	0.37	3	0.63	13	0.22	2	8.14	9	0.22	2	0.22	2	0.3	4	0.22	2	0.23	2
064	Yes	Buffalo River	9.80	10	21.11	56	8.1	10	1.76	3	8.1	10	6.44	6	6.9	3	6.33	6	3.82	4
066	Yes	Buffalo River	4.64	4	1.72	10	3.72	4	1.76	3	3.89	4	3.11	4	0.4	4	2.97	4	1.42	3
Quarry	*Yes*	*Quarry*	*21.66*	*17*			*21.62*	*17*	*82.55*	*57*	*21.63*	*17*	*21.65*	*17*	*N/A*	*N/A*	*21.63*	*17*	*786.12*	*31*

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Table E.3 Typical Year Simulation Results by Receiving Water

		New Model Baseline Condition		Old Model Baseline Condition		New Model Scheduled Projects 3/18/2022		Old Model Scheduled Projects 3/18/2022		New Model Actual Work 3/18/2022		New Model LTCP Completion		Old Model LTCP Completion		2020 LTCP Model		Selected Alternative (v3.4.0-ltcp_1b0f735)	
Receiving Water	LOC	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations
Black Rock Canal	0-4	179.81	47	319.37	65	111.81	35	20.86	10	100.49	35	28.42	15	36.40	5	27.75	15	20.68	4
Buffalo River	0-6	390.90	33	379.73	69	399.57	33	230.38	65	402.46	33	331.29	15	178.80	6	295.99	15	144.26	6
Cazenovia Creek - B	0-0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
Cazenovia Creek - C	0-6	14.31	10	35.58	44	11.21	6	11.52	6	11.25	5	9.61	5	15.40	6	12.22	9	10.55	5
Niagara River (Cornelius Creek)	0-9	722.15	38	601.09	41	621.12	31	169.61	15	632.99	33	425.86	16	206.20	9	401.54	14	320.80	9
Erie Basin Marina	0-2	28.34	12	10.33	12	18.06	10	0.44	2	17.80	10	6.37	2	3.70	2	5.86	2	5.71	2
Niagara River	0-9	286.46	39	134.29	41	220.65	35	52.53	16	222.33	35	15.61	5	11.70	4	13.76	5	22.49	4
Quarry	*N/A*	*21.66*	*17*	*0.00*	*0*	*21.62*	*17*	*82.55*	*57*	*21.63*	*17*	*21.65*	*17*	*N/A*	*N/A*	*21.63*	*17*	*786.12*	*31*
Scajaquada Creek	0-4	334.24	37	268.74	65	291.43	37	86.25	24	300.95	37	177.36	26	52.10	4	179.95	26	27.15	4

Table E.4 Typical Year Simulation Results by SPP

				Model Scenario	New Model Baseline Condition		Old Model Baseline Condition		New Model Scheduled Projects 3/18/2022		Old Model Scheduled Projects 3/18/2022		New Model Actual Work 3/18/2022		New Model LTCP Completion		Old Model LTCP Completion			2020 LTCP Model		Selected Alternative (v3.4.0-ltcp_1b0f735)	
CSO	SPP	Location	In Original Model	LTCP Model Link	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	SPP in Old Model LTCP Completion (Original 2014 LTCP) Model	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations	Typical Year OF Vol. (MG)	Typical Year OF Activations
003	003	Hertel Ave 15ft NN Cb, Thruway 45 ft EE Lane	Yes	WEIR#163	0	0	0	0	0	0	0	0	0	0	0.11	1	003	0.28	2	0	0	0.33	2
	004	Farmer St, Ctr. Thruway EE Lane	Yes	WEIR#164	0	0	0	0	0.3	2	0	0	0.31	2	0.27	2	004	0	0	0.26	2	0.29	2
	005	Austing St Ctr. Thruway 40 ft EE Lane	Yes	WEIR#165	0	0	0	0	0.27	2	0	0	0.27	2	0.35	2	005	0.40	3	0.3	2	0.56	2
	007	Hamilton St, 5ft S. N.cb, Thruway 25 ft EE Lane	Yes	WEIR#166	0	0	0	0	0	0	0	0	0	0	0	0	007	0.01	0	0	0	0	0
	008	Amherst St, Ctr Thruway, 55 ft EE Lane	Yes	WEIR#167	0	0	0	0	0	0	0	0	0	0	0	0	008	0	0	0	0	0	0
	009	Bridge St, NS Thryway, 30 ft, EE Lane	Yes	WEIR#168	0	0	0	0	0	0	0	0	0	0	0	0	009	0	0	0	0	0	0
	010	Parish St, Opp Ctr Thruway, 45 ft EE Lane	Yes	WEIR#169	0.78	4	0	0	0.95	4	0	0	0.97	4	0.82	3	010	0	0	0.78	3	0.97	4
	011	Wayne St Ctr, 100' W of W cb of Niagara St	Yes	WEIR#170	0	0	0.10	6	0	0	0	0	0	0	0	0	011	0.09	0	0	0	0	0
	184	Hamilton St Ctr, East 50 ft EE Cb	No	SPP184_w	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	184	N/A	N/A	0	0	0	0
	185	Austin St, Ctr Gurnsey St, Ctr	Yes	WEIR#171	0	0	0	0	0	0	0	0	0	0	0	0	185	0	0	0	0	0	0
	186	Farmer St Ctr Gurnsey St, 40 ft EE cb	Yes	WEIR#172	0	0	0	0	0	0	0	0	0	0	0	0	186	0	0	0	0	0	0
004	013	Bird Ave, Ctr Niagara St, 35 ft WW cb	Yes	SPP13w	4.51	5	11.22	18	5.92	5	0	0	6.2	4	9.8	5	013	8.73	3	9.41	6	3.92	2
005	014A	Potomac Ave, Ctr Niagara St20 ft WW cb	Yes	E_5882_1	0	0	0	0	0	0	0	0	0	0	0	0	014A	0	0	0	0	0	0
006	179	Harvard Pl Ctr, Lafayette St, 11 ft SS Cb	Yes	WEIR#96	13.11	15	5.67	6	14.96	15	0.18	1	14.96	15	13.5	15	179	4.05	4	13.44	15	11.72	12
	180	Delaware Ave 15ft EW Cb, Delavan Ave 5 ft NN cb	Yes	WEIR#95	74.73	47	21.91	44	3.28	7	0.16	1	3.29	7	2.92	7	180	1.86	3	2.91	7	1.02	3
	243	W Delavan Ave S Side 20' W of W Cb of Herkimer	No	SPP243_w	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	243	N/A	N/A	0	0	0	0
	331	Elmwood Ave Ctr W Delavan Centerline	Yes	WEIR#121	3.68	8	9.91	38	3.67	8	3.85	10	3.68	8	0.11	1	331	0.74	4	0.11	1	2.86	6
	Delavan Drain ILS				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.01	1
007	018	Delavan Ave, on S Cb Line Thruway, 10 ft E of W L	No	E_16877	0.37	2	N/A	N/A	0.37	2	N/A	N/A	0.32	2	0.32	2	018	N/A	N/A	0.32	2	0.31	2
008	019	Brace St Ctr, NYC RR East	Yes	5910	11.71	33	6.10	39	11.72	33	1.28	5	0	0	0	0	019	0	0	0	0	0	0
009	020	Auburn Ave, Ctr Mason 20 ft WW Cb	No	SPP020w	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	020	N/A	N/A	0	0	0	0
010	021	Breckenridge St, Ctr Thruway W edge W Lane	Yes	5555	8.15	14	11.85	44	8.15	14	0.28	2	8.11	14	0	0	021	0	0	0	0	0	0
011	024	Swan Trunk, 20 SCL Thruway, W Lane	Yes	SPP24w	286.46	39	134.29	41	220.65	35	52.53	16	222.33	35	15.61	5	024	11.65	4	13.76	5	22.49	4
012	023	Albany St, 15 ft SCL Thruway E Lane	Yes	SPP23w	11.74	12	10.11	18	11.71	12	0.81	3	11.73	12	0	0	023	0.27	2	0	0	0.11	1
	296	Albany St, 17 ft S of N line of Niagara St, 342 ft WW	Yes	SPP296w	46.6	35	42.37	44	46.38	35	6.16	7	46.53	35	0	0	296	0.65	2	0	0	0.94	3
013	304	Virginia St, 4 ft SN Cb, Busti Ave, 33 ft WW Cb	Yes	WEIR#34	4.06	4	6.75	7	3.91	4	0	0	3.9	4	0	0	304	4.14	4	0	0	2.57	4
014	206A&B	4th St 7 Ft EW Cb, Georgia St, 13 ft NN Cb	Yes	E_L9201_6	28.34	12	4.19	4	18.06	10	0.18	1	17.8	10	6.37	2	206A&B	4.00	2	5.86	2	5.71	2
015	035	Genesee St SN Cb, Up Terrace 35 ft WW Cb	Yes	WEIR2	0	0	5.41	10	0	0	0	0	0	0	0	0	035	3.11	1	0	0	0	0
	036	Church St, Ctr, 20' W of W Cb of Upper Terrace	Yes	WEIR1	0	0	0.74	13	0	0	0	0	0	0	0	0	036	0.06	0	0	0	0	0
016	042A	Charles and Bingham Street Intersection	Yes	SPP042A_w	0	0	0	0	0	0	0.26	2	0	0	0	0	042A	0	0	0	0	0	0
017	045A	Pearl St, 4 ft WE Cb, Lower Terrace, 18 ft NS Cb	No	E_7555	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	045A	N/A	N/A	0	0	0	0
	047	Main St ES, Quay SS	No	E_23083	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0.21	1	047	N/A	N/A	0.2	1	0.37	2
	048	Washington St, WS Quay SS	Yes	WEIR#2	0	0	0.12	0	0	0	0	0	0	0	0	0	048	0	0	0	0	0	0
	050	Michigan St, Ctr, Exchange St, 12 ft SS Cb	Yes	WEIR#3	0	0	0.25	2	0	0	0.1	1	0	0	0.63	2	050	0.97	2	0.54	2	0.82	2
	051	Chicago St, Ctr, Exchange St, SS Cb	Yes	WEIR#4	1.1	4	0.13	3	1.55	6	0.6	2	1.54	6	3.4	9	051			2.59	6	2.21	3
	052	Louisiana St Ctr, Exchange St SS Cb	No	W1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0.42	2	052	N/A	N/A	0.34	2	0.53	2
	053	Alabama St, Exchange St	Yes	WEIR#5	0	0	0.76	4	0.16	1	1.76	3	0.15	1	0.87	3	053			0.7	2	0.92	2
				WEIR#6	0.15	1	0.67	5	0.42	2	0	0	0.4	2	1.49	4	N/A			1.25	4	1.34	2
	054	Jefferson Ave, ES Exchange St SS Cb	No	W2	0.11	1	N/A	N/A	N/A	N/A	N/A	N/A	0.27	1	1.61	4	054	N/A	N/A	1.38	4	0	0
	055	Van Rensselaer St, Ctr, Exchange St NS Cb	Yes	WEIR#8	0	0	0.32	3	0	0	1.31	4	0	0			055					0	0
	056	Larkin St, EE Cb, Roseville St, 135 NN Cb	No	W3	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0.16	1			056	N/A	N/A			0.38	2
	058	Van Rensselaer St Ctr Roseville St NN Cb	No	W4	1.22	4	N/A	N/A	1.22	4	N/A	N/A	1.22	4			058	N/A	N/A			1.18	4
	059	Seneca St SN Cb, Hamburg St, W Cb	No	SPP059_w	2.69	10	N/A	N/A	2.42	9	N/A	N/A	2.43	9	2.14	8	059	N/A	N/A	2.03	8	0	0
	065	Swan St,Ctr, Hamburg St, WE Cb	Yes	6842w	10.17	12	0.06	2	9.66	11	1.21	2	9.76	11	7.93	9	065			7.36	7	5.91	6
	067	Hydraulic St ES 2 MH, Seneca St, 40 ft SS Cb	Yes	WEIR#9	83.79	24	52.76	18	80.24	21	5.15	4	81.53	21			067					29.74	7
	128	Hamburg St, 18 ft WE Cb, Perry St SNL	Yes	SPP128_w	0	0	0.29	5	0	0	0	0	0	0	0	0	128			2.38	12	0	0
	130	Chicago St, Ctr, Perry St Ctr	Yes	W16	0	0	2.85	49	0	0	1.26	5	0	0	0	0	130			0	0	0	0
	146	Scott St, 8 ft NS Cb W Market St, 25 ft EE Cb	No	W17	0.11	1	N/A	N/A	N/A	N/A	N/A	N/A	0.11	1	0.11	1	146	N/A	N/A	0.1	1	0	0
	281	Swan St 3 ft SS Cb, Pine Ave, 50 ft W E Cb	Yes	WEIR#33	1.67	4	13.05	14	0.87	2	5.68	4	0.87	2	0.95	2	281	9.55	4	0.93	2	0.91	2
	282	Chicago St 15 ft WE Cb, Swan St 10 ft SS Cb	Yes	SPP282w	0	0	0	0	0	0	0	0	0	0	0	0	282	0	0	0	0	0	0
	326	Oak St, Swan St Ctr	Yes	WEIR#38	30.82	15	2.65	4	30.59	15	0	0	30.62	15	23.78	9	326	2.54	2	23.44	8	5.59	4
	327	Exchange St, W of Wells	No	SPP327_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0.89	2	327	N/A	N/A	0.68	2	1.07	2
	Mill Race ILS		No	MillRaceWeir	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	21.29	10	Mill Race RTC	24.8	4	21.29	10	18.17	4
022	051A	Exchange St, 16' N of S Cb, 445' W W Cb of Chicag	No	E_19663	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	051A	N/A	N/A	0	0	0	0
	138	S Park Ave, 15 ft NS Cb, Baltimore St 45 ft EW Cb	Yes	SPP138_w	0	0	0.56	12	0	0	1.19	5	0	0	0	0	138	0.49	3	0	0	0	0
	145	Perry St, 12 ft SN Cb, Baltimore St, W edge, Frt Hs	Yes	E_4934	1.48	6	1.20	15	1.47	6	3.63	16	1.47	6	1.47	6	145	1.11	5	1.45	6	0.4	2
023	279	Chicago St, Ctr, Ohio St (2) 10 ft WE Cb	No	W23	0.28	2	N/A	N/A	0.28	2	N/A	N/A	0.28	2	0.28	2	279	N/A	N/A	0.28	2	0.26	2
025	209	Hamburg St Ctr, South St Ctr	Yes	WEIR#27	1.38	4	1.44	11	1.38	4	0.68	3	1.38	4	1.38	4	209	1.23	6	1.37	4	1.53	4
				W24	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0		N/A	N/A	0	0	0	0
	068	S Division St Ctr, WW Cb Smith St	Yes	SPP068_w	0	0	0.10	5	0	0	0	0	0	0			068					0	0
	069	Smith St EE Cb, So Division St Ctr	Yes	W5	0	0	0.63	20	0	0	0.31	2	0	0			069					0	0
	070	Smith St EE Cb, Cornelia St Ctr	No	E_10986	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0			070	N/A	N/A			0	0
	072	Smith St Ctr, Perry St 200 ft NN Cb	No	SPP072_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	072	N/A	N/A	0	0	0	0
	073	Smith St, 16 ft WW Cb, Perry St Ctr	No	E_26898	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0.35	2	073	N/A	N/A	0.59	2	0.41	2
	074	Smith St 3 ft WW Cb, Perry St 10 ft SS Cb	Yes	W6	0	0	0.02	3	0	0	0	0	0	0	0.14	1	074			0	0	0.19	1
	075	Smith St EBl, Perry St Ctr	Yes	SPP075_w	0	0	3.26	63	0	0	0.28	2	0	0	0.48	2	075			0.14	1	0.61	2
	077	Smith St WW Cb, Fulton St Ctr	Yes	W7	0.25	2	0.19	4	0.28	2	0	0	0.28	2	0.36	2	077			0.38	2	0.38	2
	078	Smith St WW Cb, Elk St NN Cb	Yes	SPP078_w	0	0	0.08	4	0	0	0	0	0	0	0	0	078			0	0	0	0
	079	Smith St WW Cb, Elk St SS Cb	Yes	SPP079_w	0	0	0.18	5	0	0	0	0	0	0	0	0	079			0	0	0	0
	080	Smith St 4 ft WE Cb, Elk St Ctr	Yes	SPP080_w	0	0	0.10	5	0	0	0	0	0	0	0	0	080			0	0	0	0
	081	Smith St 3 ft WE Cb, Elk St 130 ft SS Cb	Yes	W8	0	0	0.04	2	0.12	1	0	0	0.1	1	0.13	1	081			0.12	1	0.11	1

Table E.4 Typical Year Simulation Results by SPP

	082	Smith St 3 ft WW Cb, Prenatt St 166 ft NN Cb	Yes	SPP082_w	0	0	0.03	2	0	0	0	0	0	0	0	0	082			0	0	0	0
	084	Smith St 5 ft WW Cb, Prenatt St NS Cb	Yes	W9	0	0	0.21	7	0	0	0	0	0	0	0	0	084			0	0	0	0
	085	Smith St 3 ft EE Cb, Prenatt St 35 ft NN Cb	Yes	SPP085_w	0.3	2	0.08	2	0.53	3	0	0	0.33	2	0.79	4	085			0.44	2	0.45	2
	086	Prenatt St Ctr, Smith St 15 ft EE Cb	No	E_21473	0	0	N/A	N/A	0	0	N/A	N/A	0	0	0	0	086	N/A	N/A	0	0	0	0
	087	Smith St 5 ft WW Cb, S Park 1 ft SN Cb	Yes	W10	0	0	0.29	5	0	0	0	0	0	0	0	0	087			0	0	0	0
	088	Smith St 5 ft WW Cb, S Park SS Cb	Yes	W11	0.92	4	0.60	9	1.18	5	0.27	2	0.19	1	0.59	4	088			0.33	2	0.39	2
	089	Smith St 10 ft EE Cb, S Park 2 ft SN Cb	Yes	W12	0.11	1	0.52	5	0.15	1	0	0	0.3	2	0.82	5	089			0.48	3	0.59	3
	090	Smith St 3 ft EE Cb, S Park 2 ft SS Cb	Yes	SPP090_w	0	0	0.40	12	0	0	0.11	1	0	0	0	0	090			0	0	0	0
	091	Smith St ES Cb, S Park 50 ft SS Cb	Yes	SPP091_w	0.9	4	0.26	4	1.21	5	0	0	0.55	3	1.05	5	091			0.72	4	0.76	3
	092	Smith St WS Cb, S Park 50 ft SS Cb	Yes	SPP092_w	1.64	6	0.25	5	2.31	8	0	0	1.27	5	2.16	8	092			1.39	5	1.62	5
	094	Smith St 10 ft WW Cb, St Stephens St 2 ft NN Cb	Yes	W13	0	0	0.05	3	0	0	0	0	0	0	0	0	094			0	0	0	0
026	148	Peckham St 5 ft SN Cb, Gibson St 22 ft E Cb, 14 ft	Yes	WEIR#15	1.95	6	0.14	4	1.9	6	0	0	1.94	6			148					1.59	6
	149	Paderewski St 17 ft NS Cb, Gibson 28 ft EE Cb, Ctr	Yes	WEIR#16	2.39	6	1.01	2	2.37	6	0	0	2.37	6			149					1.62	3
	150	Broadway Ctr, Gibson St 40 ft E Cb	Yes	WEIR#18	0.52	3	0.02	2	0.5	3	0	0	0.52	3			150					0.15	1
	151	Sycamore Ctr, Mills 16 ft EE Cb, ctr, to ft WW Cb	Yes	WEIR#19	0	0	0	0	0	0	0	0	0	0			151					0	0
	152	Genesee St Ctr, Mills St Ctr	Yes	12752	2.72	10	0	0	2.72	10	0	0	2.72	10			152					2.37	10
	198B	Broadway, west of Sears St	Yes	WEIR#23	4.31	7	4.14	8	4.04	7	6.7	8	4.31	7			198B					3.3	6
	199A	Woltz Ave Ctr, Sycamore 12 ft NN Cb	Yes	WEIR#24	0.41	2	0.68	6	0.4	2	24.11	30	0.41	2			199A					0.31	2
	199B	Woltz Ave Ctr, Sycamore 6 ft SN Cb	Yes	WEIR#25	15.67	13	3.32	8	15.09	13	1.47	3	15.59	13			199B					12.51	11
	217	Emslie St Ctr, Eagle St 10 ft SS Cb	Yes	WEIR#28	21.01	16	30.21	38	14.34	13	15.28	18	15.22	13			217					11.73	13
	218	Lord Ave 10 ft EW Cb, Howard St 1 ft SS Cb	Yes	WEIR#29	5.35	8	1.86	10	4.91	8	14.11	15	5.26	8			218					4.13	7
	248	Fillmore Ave 20 ft ee Cb, Stanislaus 6 ft NN Cb	Yes	WEIR#30	1.91	5	0.05	1	1.88	5	0	0	1.91	5			248					1.45	4
	249	Genesee St 5 ft NS Cb, E Parade St 12 ft WE Cb	Yes	WEIR#31	1.07	4	0	0	1.08	4	7.99	7	1.08	4			249					0.78	3
	277	Fillmore Ave 18 ft EE Cb, Sienkewitz St 5 ft NN Cb	Yes	WEIR#32	2.53	4	0	0	2.5	4	0	0	2.52	4			277					1.84	4
	314	Eagle St 16 ft SN Cb, Smith St 8 ft EE Cbq	Yes	SPP314_w	0	0	2.17	48	0	0	0.86	4	0	0			314					0	0
	315	Eagle St 18 ft MS Cb, Montgomery St 12 ft WE Cb	No	SPP315_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0			315	N/A	N/A			0	0
	316	Eagle St Ctr, Clare St 10 ft EW Cb	No	SPP316_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0			316	N/A	N/A			0	0
	317	Filmore Ave E Cb, Clinton St 43 ft NN Cb	Yes	WEIR#35	35.84	14	23.62	13	34.77	14	24.82	14	35.53	14			317					101.68	40
	318	Clinton St 18 ft NS Cb, Fillmore Ave 42 ft EE Cb	Yes	WEIR#36	3.94	10	2.58	16	2.25	7	0	0	2.31	7			318					1.04	4
	319	Clinton St 127 ft MS Cb, Metcalfe Ave 10 ft EW Cb	Yes	WEIR#37	0.12	1	0.05	2	0	0	0	0	0	0			319					0	0
	320	Clinton St16 ft NS Cb, Lewis St 10 ft WW cb	No	SPP320_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0			320					0	0
	Lewis and Clinton	Lewis St, north of Clinton St	No	Lewis_and_Clinton_w	2.79	8	N/A	N/A	N/A	N/A	N/A	N/A	2.79	8			Lewis and Clinton	N/A	N/A			2.42	8
	Smith Street ILS		No	SmithStILSWeir	73.87	9	N/A	N/A	65.15	8	120.67	65	67.48	8	48.07	6	Smith Street ILS/OLS	29.5	3	48.7	7	40.63	6
027	097	Babcock St EW Cb, Prenatt St SNL	Yes	WEIR#10	50.67	10	30.95	7	68.42	11	21.33	3	68.59	12	100.25	11	097	39.10	6	71.37	11	42.15	4
	123A	Amber St 5 ft SN Cb, Hopkins St 10 Ft EE Cb	Yes	WEIR#64	19.07	33	7.09	13	19.07	33	2.34	4	19.07	33			123A			2.55	4	1.09	2
	123B	Amber St 17 ft SS Cb, Hopkins St 2 ft WE Cb	Yes	SPP123bw	0.88	2	17.91	71	0.88	2	13	29	0.88	2			123B			0.99	2	1.79	4
	123C	Hopkins St W Stide Opposide S Cb of Amber St	Yes	SPP123C	0	0	4.70	55	0	0	2.81	9	0	0			123C			0	0	0	0
028	123ABC OLS		No	E_7638	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	CSO 028 OLS	22.7	6	0	0	N/A	N/A
	124	Intersection of Hopkins St and Pembina St	Yes	WEIR#65	0	0	15.78	16	0	0	5.03	7	0	0	0.2	1	124			0	0	0.35	2
	125	S Park Ave 2 ft NS Cb, Boone St 2 ft WE Cb	Yes	WEIR#66	0	0	0	0	0	0	0	0	0	0	0	0	125			0	0	0	0
	125A	S Park 336.5 ; W of Inter, SW Cor So Park & Hopki	Yes	SPP125Aw	0	0	0	0	0	0	0	0	0	0	0	0	125A			0	0	0	0
	208	Mystic Ctr, Germania St 2 ft WW Cb	Yes	W19	0	0	0.03	4	0	0	0	0	0	0	0	0	208			0	0	0	0
029	126	S Park Ave 15 ft NN Cb, Boone St 30 ft WW Cb	Yes	WEIR#67	2.98	4	0	0	3.08	4	0	0	3.08	4	4.74	6	126	0	0	11.16	12	3.35	4
031	115	Kimmel St Ctr, Cazenovia Cr 24 ft SS Channel	No	W14	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	115	N/A	N/A	0	0	0	0
032	120	Buffalo River N&S side of Bailey Ave 200 ft WW Ct	Yes	WEIR#59	0	0	0	0	0	0	0	0	0	0	0	0	120	0	0	0	0	0	0
	099	Bailey Ave 4 ft EE Cb, Elk St 5 ft NN Cb	No	SPP099_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	099	N/A	N/A	0	0	0	0
	100	Bailey Ave 15 ft EE Cb, Seneca St 3 ft NS Cb	No	E_22467	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	100	N/A	N/A	0	0	0	0
033	101	Bailey Ave 15 ft EE Cb, Seneca St 3 ft NN Cb	No	E_22466	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	101	N/A	N/A	0	0	0	0
	103	Bailey Ave 15 ft EE Cb, Littel St Ctr	No	SPP103_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	103	N/A	N/A	0	0	0	0
	104	Bailey Ave Ctr, Littell St 150 ft NN Cb	Yes	WEIR#53	88.33	15	23.50	9	92.91	15	26.11	5	94.61	15	91.21	15	104	31.80	5	77.58	15	2.58	2
035	107	Cazenovia Cr @ Beyer St 750 SS Cb	Yes	SPP107w	0	0	0.94	5	0	0	0	0	0	0	0	0	107	0	0	0	0	0	0
	107A	Seneca St @ Durstein St	Yes	WEIR#60	0	0	0	0	0	0	0	0	0	0	0	0	107A	0	0	0	0	0	0
037	122	S Legion Dr Ctr, Meriden 185 ft WW Cb	Yes	WEIR#63	12.18	10	23.30	13	8.25	6	9.3	6	8.18	5	6.7	5	122	11.90	6	10.07	9	7.65	5
038	226	Seneca St 3 ft SN Cb, Kingston St 3 ft WE Cb	No	SPP226_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	226	N/A	N/A	0	0	0	0
	227	Seneca St 5 ft SS Cb, Kingston St 3 ft WE Cb	No	SPP227_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	227	N/A	N/A	0	0	0	0
	227A	Kingston Pl Ctr, 400 ft S Seneca St	No	SPP227A_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	227A	N/A	N/A	0	0	0	0
039	311	Tamarack St 5 ft WE Cb, Cumberland Ctr	Yes	WEIR#71	0	0	0	0	0	0	0	0	0	0	0	0	311	0	0	0	0	0	0
040	223	Seneca St 4 ft SS Cb, Yale St 4 ft EE Cb	No	SPP223_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	223	N/A	N/A	0	0	0	0
	224	Seneca St 3 ft SN Cb, Kamper St 3 ft WE Cb	No	SPP224_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	224	N/A	N/A	0	0	0	0
	225	Seneca St 2 ft NS Cb, Princeton Ctr	No	SPP225_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	225	N/A	N/A	0	0	0	0
042	109	N Legion Dr 5 ft NN Cb, S Ryan St Ctr	No	E_18376	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	109	N/A	N/A	0	0	0	0
	220	Seneca St 5 ft SN Cb, Ryan St 5 ft WE Cb	No	SPP220_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	220	N/A	N/A	0	0	0	0
	221	Seneca St 5 ft SS Cb. S Ryan 5 ft WE Cb	No	SPP221_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	221	N/A	N/A	0	0	0	0
	222	S Ryan St Ctr, Seneca St 500 ft SS Cb	No	W21	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	222	N/A	N/A	0	0	0	0
044	121	Mumford St Ctr, Cumberland 20 ft NN Cb	Yes	WEIR#62	0.47	2	2.32	7	1.1	3	2.22	4	1.21	3	1.05	3	121	0.70	2	0.53	2	1.02	3
046	308	Unger St 1 ft WE Cb, N Legion Dr, 5 ft NN Cb	Yes	WEIR#73	0	0	0	0	0	0	0	0	0	0	0	0	308	0	0	0	0	0	0
	308A	Unger St Ctr between Seneca and N Legion	No	SPP308A_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	308A	N/A	N/A	0	0	0	0
	308B	Unger St Ctr between Seneca and N Legion	No	SPP308B_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	308B	N/A	N/A	0	0	0	0
	309	Unger St 10 ft WE Cb, Seneca St 6 ft SS Cb	Yes	WEIR#69	0	0	0	0	0	0	0	0	0	0	0	0	309	0	0	0	0	0	0
	310	Unger St 24 ft WE Cb, Seneca St 2 ft NN Cb	Yes	WEIR#70	0	0	0	0	0	0	0	0	0	0	0	0	310	0	0	0	0	0	0
047	113	Southside Pkwy 2 ft WW Cb, S Legion Dr 3 ft NN C	Yes	WEIR#57	0	0	0	0	0	0	0	0	0	0	0	0	113	0	0	0	0	0	0
	114	Southside Pkwy 12 ft EW Cb, S Legion Dr 10 ft NN	Yes	SPP114w	1.66	4	8.65	44	1.86	5	0	0	1.86	5	1.86	5	114	1.46	3	1.62	4	1.88	5
048	118	Cazenovia Crk SS, Kimmel 110ft EW Cb	Yes	WEIR#58	0	0	0	0	0	0	0	0	0	0	0	0	118	N/A	N/A	0	0	0	0
049	119	Cazenovia Crk NS Bailey Ave 110 ft EW Cb	Yes	WEIR#61	0	0	0	0	0	0	0	0	0	0	0	0	119	0	0	0	0	0	0
050	105	Seneca St S Cb, Pomeroy 100 ft WW Cb	Yes	WEIR#55	1.57	5	3.17	14	1.54	5	2.42	5	1.55	5	1.55	5	105	2.78	5	1.44	4	1.54	5
051	307	Mineral Spring Rd 7 ft NS Cb, Frank Ave 97 Ft WW	Yes	WEIR#68	0	0	1.22	4	0	0	1	3	0	0	0	0	307	1.21	4	0	0	0	0
052	106	S Ogden St 9 ft W of Ctr, Mineral Springs Rd 35 ft N	Yes	7751	0	0	10.86	10	0	0	8.92	6	0	0	0	0	106	6.30	3	0	0	0	0

Table E.4 Typical Year Simulation Results by SPP

	156	Block St 2' S of N Cb, Theodore St 6 ' E of W Cb	Yes	WEIR#131	0	0	0	0	0	0	0	0	0	0	0	0	156	0	0	0	0	0	0
	156A	Newburgh Ave 13' EW Cb, 130' NN Cb Genesee Al	No	SPP156A_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	156A	N/A	N/A	0	0	0	0
	156B	Newburgh Ave 13 ' E W Cb, Newburgh 289' SS Cb	No	W18	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	156B	N/A	N/A	0	0	0	0
	157	Haven St 10.5' W of E Cb, 314 NN CB Genesee Alc	Yes	4419	0.1	1	0.34	5	0.11	1	0	0	0.1	1	0.11	1	157	0	0	0.11	1	0.1	1
	163	Fillmore at Northland, 4.5 ' WE Cb Fillmore, 19' SS	Yes	WEIR#108.1	2.38	8	5.02	28	0	0	0.28	1	0	0	0	0	163	1.60	4	0	0	0	0
	164	Fillmore at Delavan, 6' WE CB Fillmore at Ctr Delav	Yes	WEIR#107	0	0	0.41	5	0	0	0	0	0	0	0	0	164	0.41	3	0	0	0	0
	165	Fillmore at Delavan 6' WE Cb Fillmore, 20' NN Cb I	Yes	WEIR#106	0	0	3.00	28	0	0	0	0	0	0	0	0	165	0.34	2	0	0	0	0
	165A	Fillmore at Kensington at SE Cb intersection	Yes	WEIR#118	0.6	3	1.92	16	0	0	0	0	0	0	0	0	165A	0.30	4	0	0	0	0
	165B	E Delavan and N bound Humbolt Pkwy Service Rd	Yes	WEIR#105	1.59	5	20.64	56	1.6	5	7.64	16	1.6	5	1.58	5	165B	15.79	4	1.58	5	0	0
	166	Pansy Pl Ctr, Delavan Ave Ctr	Yes	WEIR#104	0	0	0.07	4	0	0	0	0	0	0	0	0	166	0.06	0	0	0	0	0
	175	Michigan Ave 7 ft EW Cb, Dodge St Ctr	Yes	WEIR#99	1.31	5	2.46	13	1.31	5	0.12	1	1.31	5	1.13	5	175	1.42	4	1.13	5	0	0
	176	Michigan Ave Ctr, Riley St 5 ft SS Cb	Yes	WEIR#100	0	0	0.22	6	0	0	0	0	0	0	0	0	176	0.07	0	0	0	0	0
	177	Michigan Ave Ctr, Glenwood Ave 6 ft SS Cb	Yes	WEIR#98	0	0	0.44	6	0	0	0	0	0	0	0	0	177	0.15	1	0	0	0	0
	178	Masten Ave E of Ctr, Northland Ave 23 ft NN Cb	Yes	WEIR#97	1.03	4	2.34	16	0	0	0	0	0	0	0	0	178	0.54	3	0	0	0	0
	200A	E Ferry St 10 ft NN Cb, Leslie St 12 ft EE Cb	Yes	WEIR#127	0.31	2	0.81	5	0.36	2	0	0	0.3	2	0.34	2	200A	0.55	4	0.34	2	0.3	2
	200B	E Ferry St Ctr, Leslie St 18' EE Cb	Yes	WEIR#126	0	0	0	0	0	0	0	0	0	0	0	0	200B	0	0	0	0	0	0
	201	E Ferry St Ctr, Cornwall St 9 ft EE Cb	Yes	WEIR#124	0	0	0.12	3	0	0	0	0	0	0	0	0	201	0.09	0	0	0	0	0
	202	E Ferry St Ctr, Moselle St Ctr	Yes	WEIR#123	0	0	0.93	4	0.1	1	0	0	0	0	0.11	1	202	1.34	4	0.12	1	0	0
053	203	E Ferry St Ctr, Dutton St E Line	Yes	WEIR#115	1.71	4	3.46	8	0	0	0.21	2	1.7	4	0	0	203	1.17	4	0	0	1.72	4
	204	E Ferry St Ctr, Fillmore E Cb	Yes	WEIR#114	1.77	4	1.70	10	0	0	0	0	1.76	4	0	0	204	0.61	4	0	0	1.79	4
	229	Jefferson Ave 10 ft EE Cb, Beverly 8 ft NN Cb	No	SPP229_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	229	N/A	N/A	0	0	0	0
	229A	Jefferson & Florida at NW Cb intersection	Yes	WEIR#102	2.32	6	2.67	4	2.3	6	0	0	2.3	6	2.23	6	229A	1.65	3	2.31	6	0.39	3
	247	Florida St 3 ft SN Cb, Pansey Pl 13 ft EE Cb	No	E_23908	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	247	N/A	N/A	0	0	0	0
	333	E Delavan Ave W of Spillman St	No	3397	24.8	24	59.17	65	25.25	24	14.4	24	25.25	24	4.19	2	333	5.95	2	4.2	2	6.62	4
	334A	Florida St NS of Pleasant Pl	No	SPP334A_w	0.11	1	N/A	N/A	N/A	N/A	N/A	N/A	0.11	1	0.11	1	334A	N/A	N/A	0.11	1	0.21	2
	334B	Florida St SS of Pleasant Pl	No	W20	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	334B	N/A	N/A	0	0	0	0
	335A	Hager St N Side of Florida St	Yes	WEIR#111	0	0	0.05	4	0	0	0	0	0	0	0	0	335A	0.03	0	0	0	0	0
	335B	Hager St S of Florida St	Yes	WEIR#112	2.42	6	0.96	11	1.8	4	0	0	1.85	4	1.83	4	335B	0.27	3	1.78	4	1.81	4
	336A	Humbolt Pkwy Service Rd N of Drain	Yes	WEIR#109	6.63	13	9.20	38	0.54	3	3.33	7	0.55	3	0	0	336A	0.25	1	0.55	3	0.13	1
	336B	Humbolt Pkwy Service Rd S of Drain	Yes	4400	92.49	36	94.20	45	91.58	33	33.67	17	92.26	36	33.57	8	336B	17.77	4	33.84	8	5.26	2
	337	Colorado St N of Scajaquada St	Yes	8213	26.24	19	34.98	34	26.01	20	2.02	5	26.2	19	12.12	8	337	5.61	3	11.94	8	1.76	4
	338	Bailey Ave N of Scajaquada St	Yes	WEIR#128	40.18	27	23.90	15	33.69	19	0	0	33.69	19	31.25	18	338	3.89	2	31.77	19	0	0
	339	Texas St N of Kerns Ave	Yes	WEIR#129	57.86	37	9.06	5	57.86	37	16.32	22	57.84	37	26.84	17	339	3.95	3	26.77	17	0.19	1
	340	Hagen St N of Kerns Ave	Yes	WEIR#130	54.12	23	110.00	61	46.83	16	3.53	8	41.8	16	60.45	26	340	8.60	3	61.91	26	5.48	2
	341A	Genesee St E of Kerns Ave	Yes	WEIR#132	10.95	14	18.55	60	0.51	3	0.67	3	10.96	14	0.14	1	341A	1.34	4	0.14	1	0	0
	342A	Sprenger St btw Doat and Heminway	Yes	WEIR#135	0	0	0.06	6	0	0	0	0	0	0	0	0	342A	0	0	0	0	0	0
	342B	Sprenger St btw Doat and Heminway	Yes	WEIR#134	0.83	4	0.38	8	0.84	4	0	0	0.84	4	0.84	4	342B	0	0	0.83	4	0.87	4
	345	Main St SS East of Jefferson	Yes	WEIR#103	0.36	2	0.29	5	0.52	3	0	0	0.42	2	0.41	2	345	0	0	0.41	2	0.42	2
	187	Ontario St Ctr, Crowley Ave 40 ft NN Cb	Yes	WEIR#157	0	0	0	0	0	0	0	0	0	0	0	0	187	0	0	0	0	0	0
	188	Esser St Ctr, Skillen St 20 ft SS line	Yes	WEIR#158	0	0	0	0	0	0	0	0	0	0	0	0	188	0	0	0	0	0	0
	189	Esser St Ctr, Argus St 22 ft SS Cb	Yes	WEIR#159	0	0	0	0	0	0	0	0	0	0	0	0	189	0	0	0	0	0	0
054	190	Roesch Ave 8 ft WE Cb, Argus St 10 ft SN Cb	Yes	WEIR#160	0	0	0	0	0	0	0	0	0	0	0	0	190	0	0	0	0	0	0
	191	Tonawanda St 5 ft EE Cb, Crowley Ave 5 ft SN Cb	Yes	WEIR#162	0	0	0	0	0	0	0	0	0	0	0	0	191	0	0	0	0	0	0
	193	Niagara St 10 ft EE Cb, Crowley Ave 48 ft NN Cb	No	SPP193_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	193	N/A	N/A	0	0	0	0
	280	Chadduck Ave Ctr, 12' WW Cb of Oregon Pl	No	SPP280_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	280	N/A	N/A	0	0	0	0
055	001	Cornelius Creek, SS Thruway E Lane	Yes	WEIR#156	722.15	38	601.09	41	621.12	31	169.61	15	632.99	33	425.86	16	001	206.20	9	401.54	14	320.8	9
056	244	Nottingham Ter 25 ft NN Cb, Medow Rd 10 ft EE Ct	Yes	N21	0	0	0	0	0	0	0	0	0	0	0	0	244	0	0	0	0	0	0
	245	Nottingham Ter 15' NN Cb, Easmt. 620 ft E of Linco	Yes	N22	0	0	0.03	5	0	0	0	0	0	0	0	0	245	0	0	0	0	0	0
057	195	Niagara St SS Cb, Tonawanda St 5 ft EE Cb	Yes	WEIR#174	0	0	0	0	0	0	0	0	0	0	0	0	195	0	0	0	0	0	0
058	213	Tonawanda St EE Cb, West Ave Ctr	Yes	WEIR#173	0	0	0.16	7	0	0	0	0	0	0	0	0	213	0	0	0	0	0	0
	214	Tonawanda St EE Cb, West AVe 500 ft N	No	SPP214_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	214	N/A	N/A	0	0	0	0
	215	Tonawanda St 7 ft EE Cb, Watt St NS	No	SPP215_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	215	N/A	N/A	0	0	0	0
059	181	Bradley St N Side 50' WW Cb of Grant	Yes	WEIR#82	0	0	0.48	4	0.11	1	0.22	1	0.11	1	0.11	1	181	0	0	0.11	1	0.1	1
	182	Bradley St N Side 30' WW Cb of Dart St	Yes	WEIR#83	0	0	0.61	6	0	0	0.36	2	0	0	0	0	182	0	0	0	0	0	0
	183	Bradley St NN Cb, Dewitt St Ctr	Yes	WEIR#84	4.13	12	1.06	11	0	0	0	0	0	0	0	0	183	0	0	0	0	0	0
	230	Forest Ave 3 ft SS Cb, Parkdale Ave 6 ft EE Cb	Yes	WEIR#85	0	0	0.05	3	0	0	3.38	19	0	0	0	0	230	0	0	0	0	0	0
	231	Forest Ave 6 ft SS Cb, Baynes Ave 9 ft WW Cb	Yes	WEIR#86	0	0	0.01	1	0	0	0	0	0	0	0	0	231	0	0	0	0	0	0
	232	Forest Ave 5 ft S Cb, Tremont Ave 40 ft WW Cb	Yes	WEIR#87	0	0	0.01	1	0	0	0	0	0	0	0	0	232	0	0	0	0	0	0
	233	Forest Ave 5 ft SS Cb, Claremont Ave 80 ft WW Cb	Yes	WEIR#88	0	0	0	0	0	0	0	0	0	0	0	0	233	0	0	0	0	0	0
	234	Forest Ave 3 ft SS Cb, Elmwood Ave 35 ft WW Cb	Yes	WEIR#89	0	0	0	0	0	0	0	0	0	0	0	0	234	0	0	0	0	0	0
060	235	Forest Ave 4 ft SS Cb, Lincoln Pkwy 17 ft WW Cb	Yes	WEIR#120	0	0	0.05	4	0	0	0	0	0	0	0	0	235	0	0	0	0	0	0
	236	Forest Ave 18 ft SS Cb, Windsor Ave 30 ft WW Cb	Yes	WEIR#92	0	0	0	0	0	0	0	0	0	0	0	0	236	0	0	0	0	0	0
	237	Forest Ave 13 ft SS Cb, Berkley Pl 32 ft WW Cb	Yes	WEIR#94	0	0	0.04	4	0	0	0	0	0	0	0	0	237	0	0	0	0	0	0
	238	Forest Ave 20 ft SS Cb, Windsor Ave 30 ft WW Cb	Yes	WEIR#93	0	0	0.02	2	0	0	0	0	0	0	0	0	238	0	0	0	0	0	0
	239	Forest Ave 38 ft NN Cb, Lincoln Pkwy 70 ft WW Cb	Yes	WEIR#91	0	0	0.03	3	0	0	0	0	0	0	0	0	239	0	0	0	0	0	0
	240	Forest Ave 23 ft NN Cb, Elmwood Ave 53 ft EE Cb	Yes	WEIR#90	0	0	0.44	6	0	0	0.1	1	0	0	0	0	240	0	0	0	0	0	0
	241	Forest Ave 40 ft NN Cb, Elmwood Ave 25 ft EE Cb	No	SPP241_w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	241	N/A	N/A	0	0	0	0
061	330	Niagara St at Metering Station	Yes	WEIR#80	0	0	31.18	10	0	0	0	0	0	0	0	0	330	1.23	2	0	0	9.44	2
062	022	W Ferry St 20 ft NN Cb, BR Harbor 11 ft East	No	W1_SPP022	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	022	N/A	N/A	0	0	0	0
063	283	Sheridan Terr Swan Trunk 8 ft East	Yes	SPP283w1	0.37	3	0.63	13	0.22	2	0	0	0.22	2	0.22	2	283	0.33	4	0.22	2	0.23	2
	129	Perry St 15 ft NS Cb, Ohio Drain 190 ft WW Cb	Yes	W15	0	0	1.29	40	0	0	0.49	3	0	0	0	0	129	0.91	3	0	0	0	0
	131	Fulton St 7 ft SS Cb, Ohio Drain 190 ft WW Cb	Yes	WEIR#11	2.72	6	1.62	4	2.49	6	4.45	9	2.49	6	2.56	6	131	1.73	3	2.48	6	1.27	2
	132	S Park Ave Ctr, Ohio Drain 30 ft E of CL	Yes	WEIR#12	0	0	0.07	1	0	0	0	0	0	0	0	0	132	0.04	0	0	0	0	0
064	133	S Park Ave Ctr, Chicago St 10 ft WW Cb	Yes	WEIR#13	1.62	6	1.02	12	1.62	6	1.1	4	1.62	6	1.61	6	133	0.89	3	1.61	6	1.02	4
	135A	Louisiana St Ctr, Machinaw St 10 ft NS Cb	Yes	SPP135a_w	2.11	8	4.52	56	0.92	4	2.1	8	0.91	4	0.87	4	135A	3.21	3	0.86	4	0.85	3
	136A	Louisiana St 12 ft WW Oconnell St Ctr	No	SPP136A_w	0.42	2	N/A	N/A	N/A	N/A	N/A	N/A	0.4	2	0.39	2	136A	N/A	N/A	0.39	2	0.56	2
	137	Louisiana St W of Wall, Republic St Ctr	No	E_11889	2.93	10	N/A	N/A	N/A	N/A	N/A	N/A	2.68	10	1.01	4	137	N/A	N/A	0.99	4	0.12	1
				SPP137_w2	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0		N/A	N/A	0	0	0	0
	211	CLINTON ST., 5' S.S. CB., SO. OGDEN ST., 15' E.	Yes	16115	2.51	4	1.34	12	1.61	4	1.46	3	1.68	4	1.32	3	211	0.23	2	1.25	3	0.37	1
	212	CLINTON ST., 5' S.S. CB., SO. OGDEN ST., 15' E.	Yes	16112	1.99	4	0.14	1	1.99	4	0.3	1	2.06	4	1.79	4	212	0.01	0	1.72	4	1.05	3

Table E.4 Typical Year Simulation Results by SPP

	291	Casimir St N Side 4 ' EW Cb Fenton St	Yes	SPP291_w	0	0	0.15	5	0	0	0	0	0	0	0	0	291	0.15	0	0	0	0	0
	292	Casimir St N Side and Ctr Holly St	Yes	SPP292_w	0	0	0.01	3	0	0	0	0	0	0	0	0	292	0.01	0	0	0	0	0
066	293	Casimir St N Side and Ctr Willett St	Yes	SPP293_w	0	0	0.03	4	0	0	0	0	0	0	0	0	293	0.03	0	0	0	0	0
	294	Casimir St N Side and Ctr Pontiac St	Yes	SPP294_w	0	0	0	0	0	0	0	0	0	0	0	0	294	0	0	0	0	0	0
	295	Casimir St N Side and Ctr Pierce St	Yes	SPP295_w	0	0	0	0	0	0	0	0	0	0	0	0	295	0	0	0	0	0	0
	322	William St 23 ft SN Cb, Gold St 38 ft WW Cb	Yes	12997W	0.14	1	0.06	1	0.12	1	0	0	0.15	1	0	0	322	0	0	0	0	0	0
	329	S Ogden St at Seward St	Yes	SPP329_of	0	0	0	0	0	0	0	0	0	0	0	0	329	0	0	0	0	0	0
	254	Intersection of Minnesota Ave and Bailey Ave	Yes	WEIR#152	12.98	17	21.48	55	12.96	17	16.93	37	12.97	17	12.97	17	254	21.47	38	12.96	17	19.67	31
	255	Intersection of E. Amherst St and Bailey Ave	Yes	WEIR#147	4.17	6	1.82	6	4.17	6	62.21	57	4.17	6	4.19	6	255	123.78	5	4.18	6	761.96	1
				WEIR#148	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0		N/A	N/A	0	0	0	0
	257	Near Intersection of E. Amherst St and Comstock Ave	Yes	WEIR#151	0	0	N/A	N/A	0	0	0	0	0	0	0	0	257	0	0	0	0	0	0
	258	Southwest corner of E. Amherst St and Parkridge Ave	No	SPP258w	0	0	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	258	N/A	N/A	0	0	0	0
	259	Comstock Ave, south of Berkshire Ave	Yes	WEIR#149	0	0	0.00	3	0	0	0	0	0	0	0	0	259	0	0	0	0	0	0
	260	Comstock Ave, south of Stockbridge Ave	Yes	WEIR#150	0	0	0.36	31	0	0	0	0	0	0	0	0	260	0	0	0	0	0	0
	261	Hewitt Ave, west of Comstock Ave	Yes	WEIR#140	0	0	0.15	6	0	0	0	0	0	0	0	0	261	0	0	0	0	0	0
	262	Dunlop Ave, west of Comstock Ave	Yes	WEIR#141	0	0	0.01	5	0	0	0	0	0	0	0	0	262	0	0	0	0	0	0
	263	Intersection of Dartmouth Ave and Comstock Ave	Yes	WEIR#142	0	0	0.02	5	0	0	0	0	0	0	0	0	263	0	0	0	0	0	0
Quarry	264	Intersection of Shirley Ave and Comstock Ave	Yes	WEIR#139	0	0	0	0	0	0	0	0	0	0	0	0	264	0	0	0	0	0	0
	265	Intersection of LaSalle Ave and Comstock Ave	Yes	WEIR#143	0	0	0.01	5	0	0	0	0	0	0	0	0	265	0	0	0	0	0	0
	266	Comstock Ave, south of Minnesota Ave	Yes	W22	0	0			0	0	0	0	0	0	0	0	266	0	0	0	0	0	0
	267	Comstock Ave, north of Minnesota Ave	Yes	WEIR#144	0	0	0.04	8	0	0			0	0	0	0	267	0	0	0	0	0	0
	268	Intersection of Lisbon Ave and Comstock Ave	Yes	WEIR#138	0	0	0.01	5	0	0	0	0	0	0	0	0	268	0	0	0	0	0	0
	269	East of Comstock Ave, south of Highgate Ave	Yes	SPP269_w	0	0			0	0	0	0	0	0	0	0	269	0	0	0	0	0	0
	270	East of Comstock Ave, north of Highgate Ave	Yes	SPP270_w	0	0	0.05	8	0	0			0	0	0	0	270	0	0	0	0	0	0
	271	West of Comstock Ave, south of Winspear Ave	Yes	SPP271_w	0	0	0.31	21	0	0	0	0	0	0	0	0	271	0	0	0	0	0	0
	272	West of Comstock Ave, north of Winspear Ave	Yes	SPP272_w	0	0	N/A	N/A	0	0			0	0	0	0	272	0	0	0	0	0	0
	273	Winspear Ave, west of Parkridge Ave	No	SPP273_w	0.41	2	N/A	N/A	0.41	2	N/A	N/A	0.41	2	0.41	2	273	N/A	N/A	0.41	2	0.4	2
	274	Poultney Ave, north of Kensington Ave	Yes	WEIR#154	4	13	4.38	37	3.98	13	3.41	11	3.98	13	3.98	13	274	4.39	13	3.98	13	3.99	13
	275	Poultney Ave, south of Hutchinson Ave	Yes	WEIR#145	0	0	0.06	8	0	0	0	0	0	0	0	0	275	0	0	0	0	0	0
	276	Parkridge Ave, south of Hutchinson Ave	Yes	WEIR#146	0.1	1	0.14	5	0.1	1	N/A	N/A	0.1	1	0.1	1	276	0	0	0.1	1	0.1	1
	285	Intersection of E. Amherst St and Parkridge Ave	No	WEIR#153	0	0	N/A	N/A	0	0	0	0	0	0	0	0	285	N/A	N/A	0	0	0	0

Attachment F

COST ESTIMATES FOR SELECTED ALTERNATIVE PROJECTS

Final (01/30/2023)

v3.4.0

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN SELECTED ALTERNATIVE

ENGINEER'S OPINION OF PROBABLE PROJECT COST FOR PROJECTS NOT STARTED

Project Tag/Name	Capital Cost Estimate [1,2,3]	PW O&M Cost (50 years)	PW Cost (50 years)	Size	Source
OLS Projects					
CSO014_1.2 Erie Basin Marina OLS	$ 62,440,000	$ 6,575,770	$ 69,015,770	5.55 MG	JMD draft opinion of probable constuction cost
CSO026_1.3 Collins Park OLS	$ 30,100,000	$ 2,871,770	$ 32,971,770	2.56 MG	JMD draft opinion of probable constuction cost
CSO028_1 Hopkins & Osage OLS	$ 17,640,000	$ 5,097,750	$ 22,737,750	0.95 MG	JMD draft opinion of probable constuction cost
CSO033_1 Bailey & Regent OLS	$ 53,620,000	$ 6,517,920	$ 60,137,920	4.5 MG	JMD draft opinion of probable constuction cost
CSO033_2 Clinton St OLS RTC	$ 163,800,000	$ 4,653,580	$ 168,453,580	21.72 MG	JMD draft opinion of probable constuction cost
CSO053_1.4 SPP336B OLS	$ 27,720,000	$ 3,214,370	$ 30,934,370	2.62 MG	JMD draft opinion of probable constuction cost
CSO053_5.2 Edison Martha OLS	$ 37,240,000	$ 3,243,860	$ 40,483,860	2.61 MG	JMD draft opinion of probable constuction cost
CSO053_11 Canisius OLS	$ 30,000,000	$ 2,824,460	$ 32,824,460	1.50 MG	Real Time Control Engineering Report Jefferson at Delavan (March 24, 2022) Alt 5b
CSO055_1.5 Military Rd OLS	$ 96,880,000	$ 5,934,920	$ 102,814,920	11.55 MG	JMD draft opinion of probable constuction cost
System_2 Schiller Park OLS	$ 85,960,000	$ 4,379,800	$ 90,339,800	8.00 MG	JMD draft opinion of probable constuction cost
CSO017_6 Bass Alley OLS	$ 32,620,000	$ 5,096,160	$ 37,716,160	3.60 MG	JMD draft opinion of probable constuction cost
RTC Projects					
CSO006_2 Gates Circle RTC	$ 2,835,287	$ 1,292,820	$ 4,128,107		Scajaquada Creek and Black Rock Canal Smart Sewer Project 75% Design Review Workshop (11/17/22); includes Niagara Metering Station
CSO006_3 Delavan Drain Storage/Delavan Drain Weir Raising & RTC	$ 4,000,000	$ 1,292,820	$ 5,292,820		
CSO010_1 Breckenridge Niagara RTC	$ 3,636,617	$ 1,292,820	$ 4,929,437		Scajaquada Creek and Black Rock Canal Smart Sewer Project 75% Design Review Workshop (11/17/22)
CSO014_1.1 SPP206A&B ILS Optimization/206 A&B RTC	$ 4,000,000	$ 1,292,820	$ 5,292,820		
CSO053_3.2 Amherst & Bailey RTC	$ 2,150,872	$ 1,292,820	$ 3,443,692		Scajaquada Creek and Black Rock Canal Smart Sewer Project 75% Design Review Workshop (11/17/22); includes Bailey & Kerns and Quarry Pump Station
CSO055_1.1 Hertel at Delaware ILS/Hertel North East	$ 4,000,000	$ 1,292,820	$ 5,292,820		
Sewer Separation Projects					
CSO017_1.1 SPP054 Sewer Separation	$ 700,000	$ 422,000	$ 1,122,000		JMD draft opinion of probable constuction cost
CSO064_2 Perry Street Sanitary Sewer	$ 4,800,000	$ 492,120	$ 5,292,120		JMD draft opinion of probable constuction cost
SPP Modification Projects					
CSO011_1.2 SPP024 Modification	$ 60,000	$ 115,380	$ 175,380		
CSO012_1.2 SPP023 Modification	$ 60,000	$ 115,380	$ 175,380		
CSO012_2.1 SPP296 Modification	$ 60,000	$ 115,380	$ 175,380		
CSO053_1.5 Schiller Park OLS SPP336B Modification	$ 60,000	$ 115,380	$ 175,380		
CSO053_10 SPP229A Orifice Modification (Jefferson Florida)	$ 3,000,000	$ 115,380	$ 3,115,380		Real Time Control Engineering Report Jefferson at Delavan (March 24, 2022) Alt 4
CSO053_13 SPP165B Modification	$ 60,000	$ 115,380	$ 175,380		
CSO053_14 SPP175 Modification	$ 60,000	$ 115,380	$ 175,380		
CSO053_2.5 SPP337 Modification	$ 60,000	$ 115,380	$ 175,380		
CSO053_8 SPP341A Modification	$ 60,000	$ 115,380	$ 175,380		
CSO064_1.2 SPP 137 Modification	$ 60,000	$ 115,380	$ 175,380		
System_2_3 Schiller Park OLS SPP339 Modification	$ 60,000	$ 115,380	$ 175,380		
System_2_4 Schiller Park OLS SPP340 Modification	$ 60,000	$ 115,380	$ 175,380		
CSO013_1 SPP304 Modification	$ 60,000	$ 115,380	$ 175,380		
CSO017_10 SPP051 modification	$ 60,000	$ 115,380	$ 175,380		
CSO017_8 SPP326 modification	$ 60,000	$ 115,380	$ 175,380		
CSO017_9 SPP059 modification (SPP059_w)	$ 60,000	$ 115,380	$ 175,380		
CSO027_1 Weir #35, SPP 317 modification	$ 60,000	$ 115,380	$ 175,380		
CSO027_2 Babcock PS WEIR#42 modification	$ 60,000	$ 115,380	$ 175,380		
CSO027_3 SPP97 modification(WEIR#10)	$ 60,000	$ 115,380	$ 175,380		
CSO033_3 SPP104 modification (WEIR#53)	$ 60,000	$ 115,380	$ 175,380		
CSO053_3.3 SPP254 modification	$ 232,385	$ 115,380	$ 347,765		Scajaquada Creek and Black Rock Canal Smart Sewer Project 75% Design Review Workshop (11/17/22) for Bailey & Minnesota
Other Projects					
CSO053_3.1 South Bailey DUC/ILS	$ 4,000,000	$ 1,292,820	$ 5,292,820		
System_1 Northern Relief Tunnel	$ 72,810,744	$ 2,471,480	$ 75,282,224		01/23/23 OPCC from Ed Bradfuhrer of GHD
CSO064_1.1 CSO-064 ILS	$ 4,000,000	$ 1,292,820	$ 5,292,820		
Subtotal	*$ 749,325,905*	*$ 66,561,500*	*$ 815,887,405*		
Total Selected Alternative without GI Cost	**$ 749,325,905**	**$ 66,561,500**	**$ 815,887,405**		
Green Infrastructure Projects					
CSO006_5 20% GI Implementation	$ 10,506,000	$ 2,560,043	$ 13,066,043	52.5	$200,000 / ac managed
CSO011_1.1 20% GI Implementation	$ 3,982,000	$ 970,378	$ 4,952,378	19.9	$200,000 / ac managed
CSO017_4 20% GI Implementation	$ 7,490,000	$ 1,828,602	$ 9,318,602	37.5	$200,000 / ac managed
CSO026_4 20% GI Implementation	$ 25,104,000	$ 6,119,721	$ 31,223,721	125.5	$200,000 / ac managed
CSO053_9 20% GI Implementation	$ 3,344,000	$ 814,337	$ 4,158,337	16.7	$200,000 / ac managed
CSO053_12.1 Jefferson Ave Main Beverly	$ 460,000	$ 112,154	$ 572,154	2.3	$200,000 / ac managed
CSO053_12.2 Jefferson Ave Best Beverly	$ 1,520,000	$ 368,159	$ 1,888,159	7.6	$200,000 / ac managed
CSO055_3 20% GI Implementation	$ 52,032,000	$ 12,678,306	$ 64,710,306	260	$200,000 / ac managed; life cycle cost for all GI Projects assuming permeable pavement
Total Green Infrastructure Cost	**$ 104,438,000**	**$ 25,451,700**	**$ 129,889,700**	**522**	
Total Selected Alternative Cost	**$ 853,763,905**	**$ 92,013,200**	**$ 945,777,105**		

(1) Year 2022 dollars.

(2) All Costs Rounded.

(3) Estimates include contingencies commensurate with current stage of project.

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN SELECTED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

Erie Basin Marina OLS

1/16/2023 **v3.4.0** **5.55** **MG**

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Total Cost [2]	Notes
Satellite Storage								
Land Acquisition	Acres	3	$ 100,000	$ 265,983	$ -	$ -	$ 265,983	Located in Waterfront/ Emerson Young Park (COB-owned)
Survey & Stake-out	LS	1	$ 36,450	$ 36,450	$ -	$ -	$ 36,450	
Site Clearing	SF	115,863	$ 3	$ 312,829	$ -	$ -	$ 312,829	SF of tank + 25%
Excavation	CY	62,437	$ 30	$ 1,873,110	$ -	$ -	$ 1,873,110	
Rock Excavation	CY	0	$ 200	$ -	$ -	$ -	$ -	
Piles / Foundation	LS	1	$ 500,000	$ 500,000	$ -	$ -	$ 500,000	
Bedding	CY	8,582	$ 77	$ 660,845	$ -	$ -	$ 660,845	
Structural Concrete	CY	14,375	$ 1,600	$ 22,999,476	$ -	$ -	$ 22,999,476	
Site Dewatering and Erosion Control	LS	1		$ -	$ 675,000	$ 675,000	$ 675,000	
Sheeting/Bracing	SF	18,967	$ 46	$ 872,497	$ -	$ -	$ 872,497	
Backfill	CY	34,973	$ 44	$ 1,538,826	$ -	$ -	$ 1,538,826	
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
Cleaning Equipment	LF	250	$ 4,500	$ 1,125,000	$ -	$ -	$ 1,125,000	Tipping buckets price per Koester
Access Manholes	EA	3	$ 3,100	$ 9,300	$ -	$ -	$ 9,300	
Miscellaneous Site Restoration	LS	1	$ 100,000	$ 100,000	$ -	$ -	$ 100,000	
Grass Restoration	SY	12,874	$ 9	$ 115,863	$ -	$ -	$ 115,863	Assumed equal to site clearing quantity
Satellite Storage Conveyance 1 / Connection to OLS								
Excavation	CY	578	$ 30	$ 17,332	$ -	$ -	$ 17,332	
Bedding	CY	20	$ 77	$ 1,529	$ -	$ -	$ 1,529	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	4,457	$ 46	$ 205,015	$ -	$ -	$ 205,015	
Backfill	CY	578	$ 44	$ 25,420	$ -	$ -	$ 25,420	Assumed to backfill all excavation (ignoring pipe volume)
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
4 ft Concrete Pipe	LF	153	$ 800	$ 122,525	$ -	$ -	$ 122,525	
Cut Access into Main Interceptor	LS	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	1	$ 3,100	$ 3,100	$ -	$ -	$ 3,100	
Inlet and Outlet Gates								
4 ft Inlet Gate	EA	0	$ 100,000	$ -	$ -	$ -	$ -	
		0	$ -	$ -	$ -	$ -	$ -	
Satellite Storage Force Main								
Excavation	CY	677	$ 30	$ 20,320	$ -	$ -	$ 20,320	
Bedding	CY	23	$ 77	$ 1,792	$ -	$ -	$ 1,792	
Backfill	CY	677	$ 44	$ 29,803	$ -	$ -	$ 29,803	Assumed to backfill all excavation (ignoring pipe volume)
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
Cut Access into Main Interceptor	EA	1	$ 13,500	$ 13,500	$ -	$ -	$ 13,500	
Pig Launcher	EA	1	$ 75,000	$ 75,000	$ -	$ -	$ 75,000	
1.2' ID Pipe	LF	299	$ 174	$ 52,072	$ -	$ -	$ 52,072	
Satellite Storage Pump Station								
Pumps	EA	2	$ 108,000	$ 216,000	$ 27,000	$ 54,000	$ 270,000	5.55 MGD capacity needed
Pump Station Building	SF	100	$ 2,000	$ 200,000		$ -	$ 200,000	
Piles / Foundation	LS	1	$ 100,000	$ 100,000		$ -	$ 100,000	
Piping in Tank (Including Bends)	LF	50	$ 500	$ 25,000		$ -	$ 25,000	
Check Valves	EA	2	$ 6,750	$ 13,500	$ 13,500	$ 27,000	$ 40,500	
Gate Valves	EA	2	$ 6,750	$ 13,500	$ 13,500	$ 27,000	$ 40,500	
Wet Well Isolation Gates	EA	2	$ 50,000	$ 100,000	$ 13,500	$ 27,000	$ 127,000	
Misc Metals (Grating, Handrail, Monorails, Etc.	LS	1	$ 150,000	$ 150,000	$ -	$ -	$ 150,000	
Start-up and testing	LS	1	$ 13,500	$ 13,500	$ -	$ -	$ 13,500	

Subtotal	**$**	**32,800,000**
Electrical, Controls and Instrumentation (15%)	**$**	**4,900,000**
Utility Relocation / Coordination (5%)	**$**	**1,600,000**
Environmental Remediation (5%)	**$**	**1,600,000**
MPT (5%)	**$**	**1,600,000**
General Conditions, Bonds & Insurance (5% of Subtotal)	**$**	**2,100,000**
Base Probable Construction Cost (Rounded)	**$**	**44,600,000**
Contingency (40%)	**$**	**17,840,000**
Total Probable Construction Cost	**$**	**62,440,000**
Total Probable Construction Cost per Gallon	**$**	**11.25**

(1) For items without installation cost, installation cost is included in material price.

(2) Year 2022 dollars. Does not include engineering, administrative, and legal costs or contingency.

CSO014_1.2 Erie Basin Marina - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Dewatering Pumps

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Dewatering Pumps					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Electrical Demands					
Dewatering Pumps (assumed 50 HP)	948	kWh	$ 0.14	$ 8,200	Based on activations per year, running 24 hours/activation, ME 85%, ML 90%
					Input kW = HP x Quantity x Motor Load (ML) x 0.746 / Motor Efficiency (ME)
Water for Tipping Buckets	207.20	1000 cft	$ 22.83	$ 4,730	Assumes anticipated no. activations x 100 gal/ft of tipping bucket x LF of tipping buckets
	4	quarter	$ 399.20	$ 1,597	$399.20 quarterly for 2" connection (specs mention 2" solenoid valve so flushing line is assumed to have that diameter)
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	1 millwright (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 37.31	$ 3,880	1 millwright's helper (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 43.73	$ 4,547	2 instrument techs @ 1 hour per week
Biweekly Yards and Grounds Maintenance	104	hr	$ 33.00	$ 3,432	2 laborers @ 2 hrs biweekly
Quarterly Maintenance	64	hr	$ 43.73	$ 2,798	1 millwright @ 2 days per quarter
	64	hr	$ 37.31	$ 2,388	1 millwright's helper @ 2 days per quarter
	64	hr	$ 33.00	$ 2,112	1 laborer @ 2 days per quarter
Annual Maintenance Labor (clean tank / pigging FM)	160	hr	$ 45.00	$ 7,200	2 Vactor Crews: 2 EOs @ 5 days per year
	240	hr	$ 42.00	$ 10,080	2 ERC Crews: 3 SCW @ 5 days per year
Annual Property Maintenance	1	LS	$ 2,500.00	$ 2,500	Fence repair, landscaping upkeep
ANNUAL LABOR AND UTILITY TOTAL				$ 61,212	
Millwright's Truck	168	hour	$ 20.00	$ 3,360	1 Millwright's Truck ($150,000, 5 year life) @ 168 hours per year (weekly check plus quarterly maintenance) rounded to $20/hr
ERC Truck	1	week	$ 1,153.85	$ 1,154	2 ERC Truck ($150,000, 5 year life) @ 1 week per year (annual maintenance)
Vactor Truck	1	week	$ 6,410.26	$ 6,410	2 Vactor Trucks ($500K each, 3 year life) @ 1 work week per year
Skid Steer	1	week	$ 346.15	$ 346	2 Skid Steers ($45K each, 5 year life) @ 1 work week per year
Lubricants / Misc. Supplies	1	LS	$ 1,000.00	$ 1,000	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 12,270	
				Total Cost	
Rehabilitation Expenses					
Minor Pump Rehabilitation Labor (every 2 years)	10	hr	$ 43.73	$ 437	Assumes 5 hours for 2 millwrights
Minor Pump Rehabilitation Parts (every 2 years)	1	LS	$ 1,000.00	$ 1,000	Allowance for seals and other wearing parts.
Major Pump Rehabilitation Labor (every 5 years)	48	hr	$ 43.73	$ 2,099	3 days for 2 millwrights
Major Pump Rehabilitation Parts (every 5 years)	1	LS	$ 7,500.00	$ 7,500	Assumed centrifugal pump. Allowance for bearings, impellers, full pump end work.
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Electrical Replacement Parts (every 5 years)	1	LS	$ 300.00	$ 300	Breakers, relays
Minor Electrical De-Energized Maintenance and IR scans (every 5 years)	16	hr	$ 105.29	$ 1,685	1 day electrical maintenance (assuming breakers can be fully isolated for de-energized maintenance; no generator required). IR Scan 2 people, 1 day @ $105.29/hr.
PS Building Minor Maintenance (every 10 years)	1	LS	$ 5,000.00	$ 5,000	Painting, other property maintenance
PS HVAC Equipment Replacement (every 10 years)	1	LS	$ 100,000.00	$ 100,000	In line with Babcock PS
Cleaning Equipment Replacement (every 20 years)	1	LS	$ 1,125,000.00	$ 1,125,000	May also require crane
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Pump Replacement (at year 25)	1	LS	$ 270,000.00	$ 270,000	Includes motor
Misc Metal Replacement (at year 25)	1	LS	$ 50,000.00	$ 50,000	Grating, railing, hatches
MCC Cabinet Replacement (every 30 years)	1	LS	$ 10,000.00	$ 10,000	New buckets
PS Building Rehabilitation (every 30 years)	1	LS	$ 15,000.00	$ 15,000	Roof and window replacement

ME	85%
ML	90%
Activations per year	62
Model dewatering duration per year (hours)	1313

CSO014_1.2 Erie Basin Marina - OLS Tank with Pumped Dewatering

Assumed Interest Rate : i = 5.0%
Assumed Inflation Rate I = 4.5%

	Tank and Pump Maintenance												
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Annual Parts Cost (PM. maint.)[2]	Rehab Cost (2 yr. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (10 yr. maint.)[2]	Rehab Cost (20 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Rehab Cost (30 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0													
1	$ 63,966				$ 12,822							$ 76,789	$ 73,132
2	$ 66,845	$ 477			$ 13,399	$ 1,092						$ 81,814	$ 74,207
3	$ 69,853				$ 14,002							$ 83,855	$ 72,437
4	$ 72,996	$ 521			$ 14,633	$ 1,193						$ 89,343	$ 73,502
5	$ 76,281		$ 4,715		$ 15,291		$ 28,413					$ 124,700	$ 97,705
6	$ 79,714	$ 569			$ 15,979	$ 1,302						$ 97,564	$ 72,804
7	$ 83,301				$ 16,698							$ 99,999	$ 71,067
8	$ 87,049	$ 622			$ 17,450	$ 1,422						$ 106,543	$ 72,112
9	$ 90,966				$ 18,235							$ 109,201	$ 70,392
10	$ 95,060	$ 679	$ 5,876		$ 19,055	$ 1,553	$ 35,408	$ 163,062				$ 320,692	$ 196,877
11	$ 99,338				$ 19,913							$ 119,250	$ 69,723
12	$ 103,808	$ 742			$ 20,809	$ 1,696						$ 127,054	$ 70,748
13	$ 108,479				$ 21,745							$ 130,224	$ 69,061
14	$ 113,361	$ 810			$ 22,724	$ 1,852						$ 138,746	$ 70,076
15	$ 118,462		$ 7,322		$ 23,746		$ 44,124					$ 193,655	$ 93,151
16	$ 123,793	$ 884			$ 24,815	$ 2,022						$ 151,514	$ 69,411
17	$ 129,363				$ 25,932							$ 155,295	$ 67,755
18	$ 135,185	$ 966			$ 27,099	$ 2,208						$ 165,458	$ 68,751
19	$ 141,268				$ 28,318							$ 169,586	$ 67,111
20	$ 147,625	$ 1,055	$ 9,125		$ 29,592	$ 2,412	$ 54,987	$ 253,230	$ 2,713,178			$ 3,211,204	$ 1,210,269
21	$ 154,268				$ 30,924							$ 185,192	$ 66,473
22	$ 161,210	$ 1,152			$ 32,316	$ 2,634						$ 197,311	$ 67,451
23	$ 168,465				$ 33,770							$ 202,235	$ 65,842
24	$ 176,046	$ 1,258			$ 35,289	$ 2,876						$ 215,469	$ 66,810
25	$ 183,968		$ 11,371	$ 150,272	$ 36,877		$ 68,524			$ 961,739		$ 1,412,751	$ 417,189
26	$ 192,246	$ 1,373			$ 38,537	$ 3,141						$ 235,297	$ 66,175
27	$ 200,897				$ 40,271							$ 241,169	$ 64,597
28	$ 209,938	$ 1,500			$ 42,083	$ 3,430						$ 256,950	$ 65,546
29	$ 219,385				$ 43,977							$ 263,362	$ 63,983
30	$ 229,257	$ 1,638	$ 14,170		$ 45,956	$ 3,745	$ 85,393	$ 393,258			$ 93,633	$ 867,051	$ 200,616
31	$ 239,574				$ 48,024							$ 287,598	$ 63,375
32	$ 250,355	$ 1,788			$ 50,185	$ 4,090						$ 306,418	$ 64,307
33	$ 261,621				$ 52,443							$ 314,064	$ 62,773
34	$ 273,394	$ 1,953			$ 54,803	$ 4,466						$ 334,616	$ 63,696
35	$ 285,696		$ 17,659		$ 57,270		$ 106,416					$ 467,040	$ 84,670
36	$ 298,553	$ 2,133			$ 59,847	$ 4,877						$ 365,409	$ 63,091
37	$ 311,988				$ 62,540							$ 374,527	$ 61,586
38	$ 326,027	$ 2,329			$ 65,354	$ 5,326						$ 399,036	$ 62,491
39	$ 340,698				$ 68,295							$ 408,993	$ 61,001
40	$ 356,030	$ 2,543	$ 22,006		$ 71,368	$ 5,816	$ 132,613	$ 610,718	$ 6,543,410			$ 7,744,505	$ 1,100,073
41	$ 372,051				$ 74,580							$ 446,631	$ 60,421
42	$ 388,793	$ 2,777			$ 77,936	$ 6,352						$ 475,858	$ 61,309
43	$ 406,289				$ 81,443							$ 487,732	$ 59,847
44	$ 424,572	$ 3,033			$ 85,108	$ 6,936						$ 519,649	$ 60,727
45	$ 443,678		$ 27,423		$ 88,938		$ 165,260					$ 725,299	$ 80,723
46	$ 463,643	$ 3,312			$ 92,940	$ 7,574						$ 567,470	$ 60,150
47	$ 484,507				$ 97,122							$ 581,630	$ 58,715
48	$ 506,310	$ 3,617			$ 101,493	$ 8,271						$ 619,691	$ 59,578
49	$ 529,094				$ 106,060							$ 635,154	$ 58,157
50	$ 552,903	$ 3,950	$ 34,174	$ 451,632	$ 110,833	$ 9,033	$ 205,944	$ 948,427		$ 2,890,444		$ 5,207,339	$ 454,099
													$ 6,575,770

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = F / (1 + i)^n

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN SELECTED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

Collins Park OLS

1/16/2022 **v3.4.0** **2.56** **MG**

Description	Material				Installation [1]		Total Cost [2]	Notes
	Basis	No. Units	Per Unit	Subtotal	Per Unit	Subtotal		
Satellite Storage								
Land Acquisition	Acres	1.2	$ 100,000	$ 122,569	$ -	$ -	$ 122,569	Assumed owned by COB; verify
Survey & Stake-out	LS	1	$ 36,450	$ 36,450	$ -	$ -	$ 36,450	
Site Clearing	SF	53,391	$ 3	$ 144,156	$ -	$ -	$ 144,156	SF of tank + 25%
Excavation	CY	19,775	$ 30	$ 593,236	$ -	$ -	$ 593,236	
Rock Excavation	CY	10,876	$ 200	$ 2,175,199	$ -	$ -	$ 2,175,199	
Piles / Foundation	LS		$ 500,000	$ -	$ -	$ -	$ -	Piles not needed on bedrock
Bedding	CY	3,955	$ 77	$ 304,528	$ -	$ -	$ 304,528	
Structural Concrete	CY	6,803	$ 1,200	$ 8,163,382	$ -	$ -	$ 8,163,382	
Site Dewatering and Erosion Control	LS	1		$ -	$ 675,000	$ 675,000	$ 675,000	
Sheeting/Bracing	SF	19,123	$ 46	$ 879,673	$ -	$ -	$ 879,673	
Backfill	CY	17,995	$ 44	$ 791,772	$ -	$ -	$ 791,772	
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
Cleaning Equipment	LF	85	$ 4,500	$ 382,500	$ -	$ -	$ 382,500	Tipping buckets price per Koester
Access Manholes	EA	3	$ 3,100	$ 9,300	$ -	$ -	$ 9,300	
Miscellaneous Site Restoration	LS	1	$ 100,000	$ 100,000	$ -	$ -	$ 100,000	
Pavement Restoration	SF	53,391	$ 11	$ 587,304	$ -	$ -	$ 587,304	Assumed equal to site clearing quantity
Satellite Storage Conveyance 1 / Connection to OLS								
Excavation	CY	719	$ 30	$ 21,555	$ -	$ -	$ 21,555	
Bedding	CY	24	$ 77	$ 1,848	$ -	$ -	$ 1,848	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	6,467	$ 46	$ 297,461	$ -	$ -	$ 297,461	
Backfill	CY	719	$ 44	$ 31,614	$ -	$ -	$ 31,614	Assumed to backfill all excavation (ignoring pipe volume)
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
3 ft Concrete Pipe	LF	209	$ 500	$ 104,299	$ -	$ -	$ 104,299	
Cut Access into Main Interceptor	LS	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	2	$ 3,100	$ 6,200	$ -	$ -	$ 6,200	Additional manhole for anticipated 90 deg bend
Satellite Storage Conveyance 2								
Excavation	CY	721	$ 30	$ 21,634	$ -	$ -	$ 21,634	
Bedding	CY	24	$ 77	$ 1,848	$ -	$ -	$ 1,848	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	6,490	$ 46	$ 298,546	$ -	$ -	$ 298,546	
Backfill	CY	721	$ 44	$ 31,730	$ -	$ -	$ 31,730	Assumed to backfill all excavation (ignoring pipe volume)
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
3 ft Concrete Pipe	LF	209	$ 500	$ 104,680	$ -	$ -	$ 104,680	
Cut Access into Main Interceptor	EA	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	2	$ 3,100	$ 6,200	$ -	$ -	$ 6,200	Additional manhole for anticipated 90 deg bend
Inlet and Outlet Gates								
Inlet 4' Gate	EA	1	$ 100,000	$ 100,000	$ -	$ -	$ 100,000	
Outlet 4' Gate	EA	1	$ 100,000	$ 100,000	$ -	$ -	$ 100,000	

Subtotal	**$**	**16,400,000**
Electrical, Controls and Instrumentation (15%)	**$**	**2,500,000**
Utility Relocation / Coordination (5%)	**$**	**800,000**
MPT (5%)	**$**	**800,000**
General Conditions, Bonds & Insurance (5% of Subtotal)	**$**	**1,000,000**
Base Probable Construction Cost (Rounded)	**$**	**21,500,000**
Contingency (40%)	**$**	**8,600,000**
Total Probable Construction Cost	**$**	**30,100,000**
Total Probable Construction Cost per Gallon	**$**	**11.76**

(1) For items without installation cost, installation cost is included in material price

(2) Year 2022 dollars. Does not include engineering, administrative, and legal costs or contingency

CSO026_1.3 Collins Park - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Gravity Dewatering

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Gravity Dewatering					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Water for Tipping Buckets	38.63	1000 cft	$ 22.83	$ 882	Assumes anticipated no. activations x 100 gal/ft of tipping bucket x length of tipping buckets
	4	quarter	$ 399.20	$ 1,597	$399.20 quarterly for 2" connection (specs mention 2" solenoid valve so flushing line is assumed to have that diameter)
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	1 millwright (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 37.31	$ 3,880	1 millwright's helper (1.5 x wage to capture fringe benefits) @ 2 hours per week
	26	hr	$ 43.73	$ 1,137	2 instrument techs @ 0.25 hour per week
Annual Maintenance Labor (clean tank)	160	hr	$ 45.00	$ 7,200	2 Vactor Crews: 2 EOs @ 5 days per year
	240	hr	$ 42.00	$ 10,080	2 ERC Crews: 3 SCW @ 5 days per year
ANNUAL LABOR AND UTILITY TOTAL				$ 32,523	
Millwright's Truck	104	hour	$ 20.00	$ 2,080	1 Millwright's Truck ($150,000, 5 year life) @ 104 hours per year (weekly check) rounded to $20/hr
ERC Truck	1	week	$ 1,153.85	$ 1,154	2 ERC Truck ($150,000, 5 year life) @ 1 week per year (annual maintenance)
Vactor Truck	1	week	$ 6,410.26	$ 6,410	2 Vactor Trucks ($500K each, 3 year life) @ 1 work week per year
Skid Steer	1	week	$ 346.15	$ 346	2 Skid Steers ($45K each, 5 year life) @ 1 work week per year
Lubricants / Misc. Supplies	1	LS	$ 500.00	$ 500	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 10,490	
				Total Cost	
Rehabilitation Expenses					
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Cleaning Equipment Replacement (every 20 years)	1	LS	$ 382,500.00	$ 382,500	May also require crane
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Misc Metal Replacement (at year 25)	1	LS	$ 50,000.00	$ 50,000	Grating, railing, hatches

CSO026_1.3 Collins Park - OLS Tank with Gravity Dewatering

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

	Tank Operation and Maintenance										
Year	Annual Labor and Electrical Cost	Labor Cost	Labor Cost	Labor Cost	Annual Parts Cost	Rehab Cost	Rehab Cost	Rehab Cost	Rehab Cost	Total Annual	PW
(n)	(Prev. maint.)[1,2]	(2 yr. maint.)[1,2]	(5 yr. maint.)[1,2]	(25 yr. maint.)[1,2]	(Prev. maint.)[2]	(2 yr. maint.)[2]	(5 yr. maint.)[2]	(20 yr. maint.)[2]	(25 yr. maint.)[2]	Cost	Cost[3]
0											
1	$ 33,986				$ 10,962					$ 44,949	$ 42,808
2	$ 35,516				$ 11,456					$ 46,971	$ 42,604
3	$ 37,114				$ 11,971					$ 49,085	$ 42,401
4	$ 38,784				$ 12,510					$ 51,294	$ 42,200
5	$ 40,529				$ 13,073		$ 18,693			$ 72,295	$ 56,645
6	$ 42,353				$ 13,661					$ 56,014	$ 41,799
7	$ 44,259				$ 14,276					$ 58,535	$ 41,600
8	$ 46,251				$ 14,918					$ 61,169	$ 41,401
9	$ 48,332				$ 15,590					$ 63,921	$ 41,204
10	$ 50,507				$ 16,291		$ 23,295			$ 90,092	$ 55,309
11	$ 52,780				$ 17,024					$ 69,804	$ 40,813
12	$ 55,155				$ 17,790					$ 72,945	$ 40,619
13	$ 57,637				$ 18,591					$ 76,228	$ 40,425
14	$ 60,230				$ 19,427					$ 79,658	$ 40,233
15	$ 62,941				$ 20,302		$ 29,029			$ 112,272	$ 54,005
16	$ 65,773				$ 21,215					$ 86,988	$ 39,850
17	$ 68,733				$ 22,170					$ 90,903	$ 39,661
18	$ 71,826				$ 23,168					$ 94,993	$ 39,472
19	$ 75,058				$ 24,210					$ 99,268	$ 39,284
20	$ 78,436				$ 25,299		$ 36,176	$ 922,481		$ 1,062,391	$ 400,404
21	$ 81,965				$ 26,438					$ 108,403	$ 38,911
22	$ 85,654				$ 27,628					$ 113,281	$ 38,725
23	$ 89,508				$ 28,871					$ 118,379	$ 38,541
24	$ 93,536				$ 30,170					$ 123,706	$ 38,357
25	$ 97,745			$ 150,272	$ 31,528		$ 45,082		$ 150,272	$ 474,898	$ 140,239
26	$ 102,144				$ 32,947					$ 135,090	$ 37,993
27	$ 106,740				$ 34,429					$ 141,169	$ 37,812
28	$ 111,543				$ 35,978					$ 147,522	$ 37,632
29	$ 116,563				$ 37,597					$ 154,160	$ 37,453
30	$ 121,808				$ 39,289		$ 56,180			$ 217,277	$ 50,273
31	$ 127,290				$ 41,057					$ 168,347	$ 37,097
32	$ 133,018				$ 42,905					$ 175,922	$ 36,920
33	$ 139,003				$ 44,836					$ 183,839	$ 36,744
34	$ 145,258				$ 46,853					$ 192,112	$ 36,569
35	$ 151,795				$ 48,962		$ 70,010			$ 270,767	$ 49,087
36	$ 158,626				$ 51,165					$ 209,791	$ 36,222
37	$ 165,764				$ 53,467					$ 219,231	$ 36,049
38	$ 173,223				$ 55,873					$ 229,097	$ 35,878
39	$ 181,018				$ 58,388					$ 239,406	$ 35,707
40	$ 189,164				$ 61,015		$ 87,245	$ 2,224,759		$ 2,562,184	$ 363,947
41	$ 197,677				$ 63,761					$ 261,438	$ 35,368
42	$ 206,572				$ 66,630					$ 273,202	$ 35,199
43	$ 215,868				$ 69,628					$ 285,496	$ 35,032
44	$ 225,582				$ 72,762					$ 298,344	$ 34,865
45	$ 235,733				$ 76,036		$ 108,724			$ 420,493	$ 46,799
46	$ 246,341				$ 79,458					$ 325,799	$ 34,534
47	$ 257,427				$ 83,033					$ 340,460	$ 34,369
48	$ 269,011				$ 86,770					$ 355,780	$ 34,205
49	$ 281,116				$ 90,674					$ 371,791	$ 34,043
50	$ 293,766			$ 451,632	$ 94,755		$ 135,490		$ 451,632	$ 1,427,274	$ 124,464
											$ 2,871,770

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_n(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN SELECTED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

Hopkins & Osage OLS/Osage St. Park OLS

1/17/2022 **v3.4.0** **0.95** **MG**

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Installation (1) Per Unit	Installation (1) Subtotal	Total Cost (2)	Notes
Satellite Storage								
Land Acquisition	Acres	0.4	$ 100,000	$ 36,447	$ -	$ -	$ 36,447	Assumed equal to site clearing quantity. COB property/paper street
Survey & Stake-out	LS	1	$ 36,450	$ 36,450	$ -	$ -	$ 36,450	
Site Clearing	SF	15,876	$ 3	$ 42,866	$ -	$ -	$ 42,866	SF of tank + 25%
Excavation	CY	12,383	$ 30	$ 371,504	$ -	$ -	$ 371,504	
Rock Excavation	CY	0	$ 200	$ -	$ -	$ -	$ -	
Piles / Foundation	LS	1	$ 500,000	$ 500,000	$ -	$ -	$ 500,000	
Bedding	CY	1,176	$ 77	$ 90,553	$ -	$ -	$ 90,553	
Structural Concrete	CY	2,103	$ 1,600	$ 3,364,288	$ -	$ -	$ 3,364,288	
Site Dewatering and Erosion Control	LS	1		$ -	$ 675,000	$ 675,000	$ 675,000	
Sheeting/Bracing	SF	10,367	$ 46	$ 476,899	$ -	$ -	$ 476,899	
Backfill	CY	7,679	$ 44	$ 337,894	$ -	$ -	$ 337,894	
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
Cleaning Equipment	LF	85	$ 4,500	$ 382,500	$ -	$ -	$ 382,500	Tipping buckets price per Koester
Access Manholes	EA	3	$ 3,100	$ 9,300	$ -	$ -	$ 9,300	
Miscellaneous Site Restoration	LS	1	$ 200,000	$ 200,000	$ -	$ -	$ 200,000	For misc site and pipe trench restoration
Grass Restoration	SY	1,764	$ 9	$ 15,876	$ -	$ -	$ 15,876	Assumed equal to site clearing quantity
Satellite Storage Conveyance 1 / Connection to OLS								
Excavation	CY	1,601	$ 30	$ 48,038	$ -	$ -	$ 48,038	
Bedding	CY	39	$ 77	$ 3,003	$ -	$ -	$ 3,003	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	14,411	$ 46	$ 662,921	$ -	$ -	$ 662,921	
Backfill	CY	14,411	$ 44	$ 634,098	$ -	$ -	$ 634,098	Assumed to be the same as volume excavated
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
3 ft Concrete Pipe	LF	342	$ 500	$ 171,075	$ -	$ -	$ 171,075	Unit price is for 3.5 ft pipe
Cut Access into Main Interceptor	LS	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	2	$ 3,100	$ 6,200	$ -	$ -	$ 6,200	
Inlet and Outlet Gates								
4 ft Inlet RTC Gate	EA	1	$ 100,000	$ 100,000	$ -	$ -	$ 100,000	Broadway Oak RTC gates $100,000 each
		0	$ -	$ -	$ -	$ -	$ -	
Satellite Storage Force Main								
Excavation	CY	3,068	$ 30	$ 92,047	$ -	$ -	$ 92,047	
Bedding	CY	73	$ 77	$ 5,621	$ -	$ -	$ 5,621	
Backfill	CY	3,068	$ 44	$ 135,003	$ -	$ -	$ 135,003	Assumed to be the same as volume excavated
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
Cut Access into Main Interceptor	EA	1	$ 13,500	$ 13,500	$ -	$ -	$ 13,500	
Pig Launcher	EA	1	$ 50,000	$ 50,000	$ -	$ -	$ 50,000	
6" ID Pipe	LF	1,124	$ 125	$ 140,487	$ -	$ -	$ 140,487	
Satellite Storage Pump Station								
Pumps	EA	2	$ 54,000	$ 108,000	$ 27,000	$ 54,000	$ 162,000	
Pump Station Building	SF	100	$ 2,000	$ 200,000		$ -	$ 200,000	
Piles / Foundation	LS	1	$ 100,000	$ 100,000		$ -	$ 100,000	
Piping in Tank (Including Bends)	LF	50	$ 500	$ 25,000		$ -	$ 25,000	
Check Valves	EA	2	$ 6,750	$ 13,500	$ 13,500	$ 27,000	$ 40,500	
Gate Valves	EA	2	$ 6,750	$ 13,500	$ 13,500	$ 27,000	$ 40,500	
Wet Well Isolation Gates	EA	2	$ 50,000	$ 100,000	$ 13,500	$ 27,000	$ 127,000	
Misc Metals (Grating, Handrail, Monorails, Etc.)	LS	1	$ 150,000	$ 150,000	$ -	$ -	$ 150,000	
Start-up and testing	LS	1	$ 13,500	$ 13,500	$ -	$ -	$ 13,500	
SPP Modifications								
Raise SPP123A Weir	LS	1	$ 50,000	$ 50,000	$ -	$ -	$ 50,000	
		0		$ -	$ -	$ -	$ -	

Subtotal	$	**9,600,000**
Electrical, Controls and Instrumentation (15%)	$	**1,400,000**
Utility Relocation / Coordination (5%)	$	**500,000**
MPT (5%)	$	**500,000**
General Conditions, Bonds & Insurance (5% of Subtotal)	$	**600,000**
Base Probable Construction Cost (Rounded)	$	**12,600,000**
Contingency (40%)	$	**5,040,000**
Total Probable Construction Cost	$	**17,640,000**
Total Probable Construction Cost per Gallon	$	**18.57**

(1) For items without installation cost, installation cost is included in material price.

(2) Year 2022 dollars. Does not include engineering, administrative, and legal costs or contingency.

CSO028_1 Hopkins & Osage - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Dewatering Pumps

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Dewatering Pumps					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Electrical Demands					
Dewatering Pumps (assumed 50 HP)	948	kWh	$ 0.14	$ 11,800	Based on activations per year, running 24 hours/activation, ME 85%, ML 90%
					Input kW = HP x Quantity x Motor Load (ML) x 0.746 / Motor Efficiency (ME)
Water for Tipping Buckets	101.13	1000 cft	$ 22.83	$ 2,309	Assumes anticipated no. activations x 100 gal/ft of tipping bucket x length of tipping buckets
	4	quarter	$ 399.20	$ 1,597	$399.20 quarterly for 2" connection (specs mention 2" solenoid valve so flushing line is assumed to have that diameter)
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	1 millwright (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 37.31	$ 3,880	1 millwright's helper (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 43.73	$ 4,547	2 instrument techs @ 1 hour per week
Biweekly Yards and Grounds Maintenance	104	hr	$ 33.00	$ 3,432	2 laborers @ 2 hrs biweekly
Quarterly Maintenance	64	hr	$ 43.73	$ 2,798	1 millwright @ 2 days per quarter
	64	hr	$ 37.31	$ 2,388	1 millwright's helper @ 2 days per quarter
	64	hr	$ 33.00	$ 2,112	1 laborer @ 2 days per quarter
Annual Maintenance Labor (clean tank / pigging FM)	160	hr	$ 45.00	$ 7,200	2 Vactor Crews: 2 EOs @ 5 days per year
	240	hr	$ 42.00	$ 10,080	2 ERC Crews: 3 SCW @ 5 days per year
Annual Property Maintenance	1	LS	$ 2,500.00	$ 2,500	Fence repair, landscaping upkeep
ANNUAL LABOR AND UTILITY TOTAL				$ 62,390	
Millwright's Truck	168	hour	$ 20.00	$ 3,360	1 Millwright's Truck ($150,000, 5 year life) @ 168 hours per year (weekly check plus quarterly maintenance) rounded to $20/hr
ERC Truck	1	week	$ 1,153.85	$ 1,154	2 ERC Truck ($150,000, 5 year life) @ 1 week per year (annual maintenance)
Vactor Truck	1	week	$ 6,410.26	$ 6,410	2 Vactor Trucks ($500K each, 3 year life) @ 1 work week per year
Skid Steer	1	week	$ 346.15	$ 346	2 Skid Steers ($45K each, 5 year life) @ 1 work week per year
Lubricants / Misc. Supplies	1	LS	$ 1,000.00	$ 1,000	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 12,270	
				Total Cost	
Rehabilitation Expenses					
Minor Pump Rehabilitation Labor (every 2 years)	10	hr	$ 43.73	$ 437	Assumes 5 hours for 2 millwrights
Minor Pump Rehabilitation Parts (every 2 years)	1	LS	$ 1,000.00	$ 1,000	Allowance for seals and other wearing parts.
Major Pump Rehabilitation Labor (every 5 years)	48	hr	$ 43.73	$ 2,099	3 days for 2 millwrights
Major Pump Rehabilitation Parts (every 5 years)	1	LS	$ 7,500.00	$ 7,500	Assumed centrifugal pump. Allowance for bearings, impellers, full pump end work.
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Electrical Replacement Parts (every 5 years)	1	LS	$ 300.00	$ 300	Breakers, relays
Minor Electrical De-Energized Maintenance and IR scans (every 5 years)	16	hr	$ 105.29	$ 1,685	1 day electrical maintenance (assuming breakers can be fully isolated for de-energized maintenance; no generator required). IR Scan 2 people, 1 day @ $105.29/hr.
PS Building Minor Maintenance (every 10 years)	1	LS	$ 5,000.00	$ 5,000	Painting, other property maintenance
PS HVAC Equipment Replacement (every 10 years)	1	LS	$ 100,000.00	$ 100,000	In line with Babcock PS
Cleaning Equipment Replacement (every 20 years)	1	LS	$ 382,500.00	$ 382,500	May also require crane
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Pump Replacement (at year 25)	1	LS	$ 162,000.00	$ 162,000	Includes motor
Misc Metal Replacement (at year 25)	1	LS	$ 50,000.00	$ 50,000	Grating, railing, hatches
MCC Cabinet Replacement (every 30 years)	1	LS	$ 10,000.00	$ 10,000	New buckets
PS Building Rehabilitation (every 30 years)	1	LS	$ 15,000.00	$ 15,000	Roof and window replacement

CSO028_1 Hopkins & Osage - OLS Tank with Pumped Dewatering

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

	Tank and Pump Maintenance												
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Annual Parts Cost (PM. maint.)[2]	Rehab Cost (2 yr. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (10 yr. maint.)[2]	Rehab Cost (20 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Rehab Cost (30 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0													
1	$ 65,198				$ 12,822							$ 78,020	$ 74,305
2	$ 68,131	$ 477			$ 13,399	$ 1,092						$ 83,100	$ 75,375
3	$ 71,197				$ 14,002							$ 85,200	$ 73,599
4	$ 74,401	$ 521			$ 14,633	$ 1,193						$ 90,748	$ 74,658
5	$ 77,749		$ 4,715		$ 15,291		$ 28,413					$ 126,168	$ 98,856
6	$ 81,248	$ 569			$ 15,979	$ 1,302						$ 99,099	$ 73,949
7	$ 84,904				$ 16,698							$ 101,602	$ 72,207
8	$ 88,725	$ 622			$ 17,450	$ 1,422						$ 108,218	$ 73,246
9	$ 92,718				$ 18,235							$ 110,952	$ 71,521
10	$ 96,890	$ 679	$ 5,876		$ 19,055	$ 1,553	$ 35,408	$ 163,062				$ 322,522	$ 198,001
11	$ 101,250				$ 19,913							$ 121,163	$ 70,841
12	$ 105,806	$ 742			$ 20,809	$ 1,696						$ 129,052	$ 71,861
13	$ 110,567				$ 21,745							$ 132,313	$ 70,168
14	$ 115,543	$ 810			$ 22,724	$ 1,852						$ 140,928	$ 71,178
15	$ 120,742		$ 7,322		$ 23,746		$ 44,124					$ 195,935	$ 94,248
16	$ 126,176	$ 884			$ 24,815	$ 2,022						$ 153,897	$ 70,502
17	$ 131,854				$ 25,932							$ 157,785	$ 68,841
18	$ 137,787	$ 966			$ 27,099	$ 2,208						$ 168,060	$ 69,832
19	$ 143,987				$ 28,318							$ 172,305	$ 68,187
20	$ 150,467	$ 1,055	$ 9,125		$ 29,592	$ 2,412	$ 54,987	$ 253,230	$ 922,481			$ 1,423,348	$ 536,445
21	$ 157,238				$ 30,924							$ 188,162	$ 67,539
22	$ 164,314	$ 1,152			$ 32,316	$ 2,634						$ 200,414	$ 68,512
23	$ 171,708				$ 33,770							$ 205,478	$ 66,898
24	$ 179,435	$ 1,258			$ 35,289	$ 2,876						$ 218,858	$ 67,861
25	$ 187,509		$ 11,371	$ 150,272	$ 36,877		$ 68,524			$ 637,152		$ 1,091,705	$ 322,384
26	$ 195,947	$ 1,373			$ 38,537	$ 3,141						$ 238,998	$ 67,216
27	$ 204,765				$ 40,271							$ 245,036	$ 65,632
28	$ 213,979	$ 1,500			$ 42,083	$ 3,430						$ 260,992	$ 66,577
29	$ 223,608				$ 43,977							$ 267,585	$ 65,009
30	$ 233,670	$ 1,638	$ 14,170		$ 45,956	$ 3,745	$ 85,393	$ 393,258			$ 93,633	$ 777,831	$ 179,973
31	$ 244,186				$ 48,024							$ 292,210	$ 64,391
32	$ 255,174	$ 1,788			$ 50,185	$ 4,090						$ 311,237	$ 65,318
33	$ 266,657				$ 52,443							$ 319,100	$ 63,779
34	$ 278,656	$ 1,953			$ 54,803	$ 4,466						$ 339,879	$ 64,698
35	$ 291,196		$ 17,659		$ 57,270		$ 106,416					$ 472,540	$ 85,667
36	$ 304,300	$ 2,133			$ 59,847	$ 4,877						$ 371,156	$ 64,083
37	$ 317,993				$ 62,540							$ 380,533	$ 62,573
38	$ 332,303	$ 2,329			$ 65,354	$ 5,326						$ 405,312	$ 63,474
39	$ 347,257				$ 68,295							$ 415,552	$ 61,979
40	$ 362,883	$ 2,543	$ 22,006		$ 71,368	$ 5,816	$ 132,613	$ 610,718	$ 2,224,759			$ 3,432,708	$ 487,601
41	$ 379,213				$ 74,580							$ 453,793	$ 61,390
42	$ 396,277	$ 2,777			$ 77,936	$ 6,352						$ 483,342	$ 62,274
43	$ 414,110				$ 81,443							$ 495,553	$ 60,807
44	$ 432,745	$ 3,033			$ 85,108	$ 6,936						$ 527,822	$ 61,682
45	$ 452,218		$ 27,423		$ 88,938		$ 165,260					$ 733,840	$ 81,674
46	$ 472,568	$ 3,312			$ 92,940	$ 7,574						$ 576,395	$ 61,096
47	$ 493,834				$ 97,122							$ 590,956	$ 59,657
48	$ 516,056	$ 3,617			$ 101,493	$ 8,271						$ 629,437	$ 60,515
49	$ 539,279				$ 106,060							$ 645,339	$ 59,090
50	$ 563,546	$ 3,950	$ 34,174		$ 110,833	$ 9,033	$ 205,944	$ 948,427		$ 1,914,919		$ 3,790,826	$ 330,574
													$ 5,097,750

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN SELECTED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

Bailey & Regent OLS (Moreland Park)

1/17/2022 **v3.4.0** **4.50** **MG**

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Total Cost [2]	Notes
Satellite Storage								
Land Acquisition	Acres	2	$ 100,000	$ 208,318	$ -	$ -	$ 208,318	Area equal to site clearing area. Property owned by COB police
Survey & Stake-out	LS	1	$ 36,450	$ 36,450	$ -	$ -	$ 36,450	
Site Clearing	SF	90,744	$ 3	$ 245,008	$ -	$ -	$ 245,008	SF of tank + 25%
Excavation	CY	40,331	$ 30	$ 1,209,917	$ -	$ -	$ 1,209,917	
Rock Excavation	CY	30,752	$ 200	$ 6,150,410	$ -	$ -	$ 6,150,410	
Piles / Foundation	LS	0	$ 500,000	$ -	$ -	$ -	$ -	Piles not required on bedrock
Bedding	CY	6,722	$ 77	$ 517,575	$ -	$ -	$ 517,575	
Structural Concrete	CY	11,126	$ 1,200	$ 13,351,396	$ -	$ -	$ 13,351,396	
Site Dewatering and Erosion Control	LS	1		$ -	$ 675,000	$ 675,000	$ 675,000	
Sheeting/Bracing	SF	24,094	$ 46	$ 1,108,334	$ -	$ -	$ 1,108,334	
Backfill	CY	48,766	$ 44	$ 2,145,720	$ -	$ -	$ 2,145,720	
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
Cleaning Equipment	LF	240	$ 4,500	$ 1,080,000	$ -	$ -	$ 1,080,000	Tipping buckets price per Koester
Access Manholes	EA	3	$ 3,100	$ 9,300	$ -	$ -	$ 9,300	
Miscellaneous Site Restoration	LS	1	$ 200,000	$ 200,000	$ -	$ -	$ 200,000	misc site and pipe trench restoration
Grass Restoration	SY	10,083	$ 9	$ 90,744	$ -	$ -	$ 90,744	Assumed equal to site clearing quantity
Satellite Storage Conveyance 1 / Connection to OLS								
Excavation	CY	1,179	$ 30	$ 35,365	$ -	$ -	$ 35,365	
Bedding	CY	28	$ 77	$ 2,156	$ -	$ -	$ 2,156	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	7,957	$ 46	$ 366,024	$ -	$ -	$ 366,024	
Backfill	CY	1,179	$ 44	$ 51,868	$ -	$ -	$ 51,868	Assumed equal to excavation quantity
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
5 ft Concrete Pipe	LF	188	$ 900	$ 169,299	$ -	$ -	$ 169,299	
Cut Access into Main Interceptor	LS	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	1	$ 3,100	$ 3,100	$ -	$ -	$ 3,100	
Inlet and Outlet Gates								
6 ft Diameter Inlet Gate	EA	1	$ 150,000	$ 150,000	$ -	$ -	$ 150,000	Broadway Oak RTC gates $100,000 each
			$ -	$ -	$ -	$ -	$ -	
Satellite Storage Force Main								
Excavation	CY	1,350	$ 30	$ 40,508	$ -	$ -	$ 40,508	
Bedding	CY	32	$ 77	$ 2,464	$ -	$ -	$ 2,464	
Backfill	CY	1,350	$ 44	$ 59,412	$ -	$ -	$ 59,412	Assumed equal to excavation quantity
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
Cut Access into Main Interceptor	EA	1	$ 13,500	$ 13,500	$ -	$ -	$ 13,500	
Pig Launcher	EA	1	$ 75,000	$ 75,000	$ -	$ -	$ 75,000	
14" ID Pipe	LF	414	$ 174	$ 71,984	$ -	$ -	$ 71,984	
Satellite Storage Pump Station								
Pumps	EA	2	$ 65,000	$ 130,000	$ 27,000	$ 54,000	$ 184,000	4.5 MGD dewatering capacity needed
Pump Station Building	SF	100	$ 2,000	$ 200,000		$ -	$ 200,000	
Piles / Foundation	LS	1	$ 100,000	$ 100,000		$ -	$ 100,000	
Piping in Tank (Including Bends)	LF	50	$ 500	$ 25,000		$ -	$ 25,000	
Check Valves	EA	2	$ 6,750	$ 13,500	$ 13,500	$ 27,000	$ 40,500	
Gate Valves	EA	2	$ 6,750	$ 13,500	$ 13,500	$ 27,000	$ 40,500	
Wet Well Isolation Gates	EA	2	$ 50,000	$ 100,000	$ 13,500	$ 27,000	$ 127,000	
Misc Metals (Grating, Handrail, Monorails, Etc.	LS	1	$ 150,000	$ 150,000	$ -	$ -	$ 150,000	
Start-up and testing	LS	1	$ 13,500	$ 13,500	$ -	$ -	$ 13,500	

Subtotal	**$ 29,100,000**
Electrical, Controls and Instrumentation (15%)	**$ 4,400,000**
Utility Relocation / Coordination (5%)	**$ 1,500,000**
MPT (5%)	**$ 1,500,000**
General Conditions, Bonds & Insurance (5% of Subtotal)	**$ 1,800,000**
Base Probable Construction Cost (Rounded)	**$ 38,300,000**
Contingency (40%)	**$ 15,320,000**
Total Probable Construction Cost	**$ 53,620,000**
Total Probable Construction Cost per Gallon	**$ 11.92**

(1) For items without installation cost, installation cost is included in material price.
(2) Year 2022 dollars. Does not include engineering, administrative, and legal costs or contingency.

CSO033_1 Bailey & Regent - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Dewatering Pumps

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Dewatering Pumps					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Electrical Demands					
Dewatering Pumps (assumed 50 HP)	948	kWh	$ 0.14	$ 10,700	Based on activations per year, running 24 hours/activation, ME 85%, ML 90%
					Input kW = HP x Quantity x Motor Load (ML) x 0.746 / Motor Efficiency (ME)
Water for Tipping Buckets	259.88	1000 cft	$ 22.83	$ 5,933	Assumes anticipated no. activations x 100 gal/ft of tipping bucket x length of tipping buckets
	4	quarter	$ 399.20	$ 1,597	$399.20 quarterly for 2" connection (specs mention 2" solenoid valve so flushing line is assumed to have that diameter)
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	1 millwright (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 37.31	$ 3,880	1 millwright's helper (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 43.73	$ 4,547	2 instrument techs @ 1 hour per week
Biweekly Yards and Grounds Maintenance	104	hr	$ 33.00	$ 3,432	2 laborers @ 2 hrs biweekly
Quarterly Maintenance	64	hr	$ 43.73	$ 2,798	1 millwright @ 2 days per quarter
	64	hr	$ 37.31	$ 2,388	1 millwright's helper @ 2 days per quarter
	64	hr	$ 33.00	$ 2,112	1 laborer @ 2 days per quarter
Annual Maintenance Labor (clean tank / pigging FM)	160	hr	$ 45.00	$ 7,200	2 Vactor Crews: 2 EOs @ 5 days per year
	240	hr	$ 42.00	$ 10,080	2 ERC Crews: 3 SCW @ 5 days per year
Annual Property Maintenance	1	LS	$ 2,500.00	$ 2,500	Fence repair, landscaping upkeep
ANNUAL LABOR AND UTILITY TOTAL				$ 64,914	
Millwright's Truck	168	hour	$ 20.00	$ 3,360	1 Millwright's Truck ($150,000, 5 year life) @ 168 hours per year (weekly check plus quarterly maintenance) rounded to $20/hr
ERC Truck	1	week	$ 1,153.85	$ 1,154	2 ERC Truck ($150,000, 5 year life) @ 1 week per year (annual maintenance)
Vactor Truck	1	week	$ 6,410.26	$ 6,410	2 Vactor Trucks ($500K each, 3 year life) @ 1 work week per year
Skid Steer	1	week	$ 346.15	$ 346	2 Skid Steers ($45K each, 5 year life) @ 1 work week per year
Lubricants / Misc. Supplies	1	LS	$ 1,000.00	$ 1,000	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 12,270	
				Total Cost	
Rehabilitation Expenses					
Minor Pump Rehabilitation Labor (every 2 years)	10	hr	$ 43.73	$ 437	Assumes 5 hours for 2 millwrights
Minor Pump Rehabilitation Parts (every 2 years)	1	LS	$ 1,000.00	$ 1,000	Allowance for seals and other wearing parts.
Major Pump Rehabilitation Labor (every 5 years)	48	hr	$ 43.73	$ 2,099	3 days for 2 millwrights
Major Pump Rehabilitation Parts (every 5 years)	1	LS	$ 7,500.00	$ 7,500	Assumed centrifugal pump. Allowance for bearings, impellers, full pump end work.
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Electrical Replacement Parts (every 5 years)	1	LS	$ 300.00	$ 300	Breakers, relays
Minor Electrical De-Energized Maintenance and IR scans (every 5 years)	16	hr	$ 105.29	$ 1,685	1 day electrical maintenance (assuming breakers can be fully isolated for de-energized maintenance; no generator required). IR Scan 2 people, 1 day @ $105.29/hr.
PS Building Minor Maintenance (every 10 years)	1	LS	$ 5,000.00	$ 5,000	Painting, other property maintenance
PS HVAC Equipment Replacement (every 10 years)	1	LS	$ 100,000.00	$ 100,000	In line with Babcock PS
Cleaning Equipment Replacement (every 20 years)	1	LS	$ 1,080,000.00	$ 1,080,000	May also require crane
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Pump Replacement (at year 25)	1	LS	$ 184,000.00	$ 184,000	Includes motor
Misc Metal Replacement (at year 25)	1	LS	$ 50,000.00	$ 50,000	Grating, railing, hatches
MCC Cabinet Replacement (every 30 years)	1	LS	$ 10,000.00	$ 10,000	New buckets
PS Building Rehabilitation (every 30 years)	1	LS	$ 15,000.00	$ 15,000	Roof and window replacement

CSO033_1 Bailey & Regent - OLS Tank with Pumped Dewatering

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

	Tank and Pump Maintenance												
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Annual Parts Cost (PM. maint.)[2]	Rehab Cost (2 yr. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (10 yr. maint.)[2]	Rehab Cost (20 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Rehab Cost (30 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0													
1	$ 67,835				$ 12,822							$ 80,658	$ 76,817
2	$ 70,888	$ 477			$ 13,399	$ 1,092						$ 85,857	$ 77,875
3	$ 74,078				$ 14,002							$ 88,080	$ 76,087
4	$ 77,411	$ 521			$ 14,633	$ 1,193						$ 93,758	$ 77,135
5	$ 80,895		$ 4,715		$ 15,291		$ 28,413					$ 129,314	$ 101,321
6	$ 84,535	$ 569			$ 15,979	$ 1,302						$ 102,386	$ 76,402
7	$ 88,339				$ 16,698							$ 105,037	$ 74,648
8	$ 92,315	$ 622			$ 17,450	$ 1,422						$ 111,808	$ 75,676
9	$ 96,469				$ 18,235							$ 114,703	$ 73,939
10	$ 100,810	$ 679	$ 5,876		$ 19,055	$ 1,553	$ 35,408	$ 163,062				$ 326,442	$ 200,407
11	$ 105,346				$ 19,913							$ 125,259	$ 73,236
12	$ 110,087	$ 742			$ 20,809	$ 1,696						$ 133,333	$ 74,245
13	$ 115,041				$ 21,745							$ 136,786	$ 72,541
14	$ 120,217	$ 810			$ 22,724	$ 1,852						$ 145,603	$ 73,539
15	$ 125,627		$ 7,322		$ 23,746		$ 44,124					$ 200,820	$ 96,598
16	$ 131,281	$ 884			$ 24,815	$ 2,022						$ 159,002	$ 72,841
17	$ 137,188				$ 25,932							$ 163,120	$ 71,169
18	$ 143,362	$ 966			$ 27,099	$ 2,208						$ 173,634	$ 72,149
19	$ 149,813				$ 28,318							$ 178,131	$ 70,492
20	$ 156,554	$ 1,055	$ 9,125		$ 29,592	$ 2,412	$ 54,987	$ 253,230	$ 2,604,651			$ 3,111,606	$ 1,172,732
21	$ 163,599				$ 30,924							$ 194,523	$ 69,823
22	$ 170,961	$ 1,152			$ 32,316	$ 2,634						$ 207,062	$ 70,784
23	$ 178,655				$ 33,770							$ 212,424	$ 69,159
24	$ 186,694	$ 1,258			$ 35,289	$ 2,876						$ 226,117	$ 70,112
25	$ 195,095		$ 11,371	$ 150,272	$ 36,877		$ 68,524			$ 703,272		$ 1,165,411	$ 344,149
26	$ 203,875	$ 1,373			$ 38,537	$ 3,141						$ 246,925	$ 69,446
27	$ 213,049				$ 40,271							$ 253,320	$ 67,851
28	$ 222,636	$ 1,500			$ 42,083	$ 3,430						$ 269,649	$ 68,786
29	$ 232,655				$ 43,977							$ 276,632	$ 67,207
30	$ 243,124	$ 1,638	$ 14,170		$ 45,956	$ 3,745	$ 85,393	$ 393,258			$ 93,633	$ 880,918	$ 203,825
31	$ 254,065				$ 48,024							$ 302,089	$ 66,568
32	$ 265,498	$ 1,788			$ 50,185	$ 4,090						$ 321,561	$ 67,485
33	$ 277,445				$ 52,443							$ 329,889	$ 65,936
34	$ 289,930	$ 1,953			$ 54,803	$ 4,466						$ 351,153	$ 66,844
35	$ 302,977		$ 17,659		$ 57,270		$ 106,416					$ 484,321	$ 87,803
36	$ 316,611	$ 2,133			$ 59,847	$ 4,877						$ 383,468	$ 66,209
37	$ 330,859				$ 62,540							$ 393,398	$ 64,689
38	$ 345,747	$ 2,329			$ 65,354	$ 5,326						$ 418,756	$ 65,579
39	$ 361,306				$ 68,295							$ 429,601	$ 64,074
40	$ 377,565	$ 2,543	$ 22,006		$ 71,368	$ 5,816	$ 132,613	$ 610,718	$ 6,281,674			$ 7,504,303	$ 1,065,954
41	$ 394,555				$ 74,580							$ 469,135	$ 63,465
42	$ 412,310	$ 2,777			$ 77,936	$ 6,352						$ 499,375	$ 64,339
43	$ 430,864				$ 81,443							$ 512,307	$ 62,862
44	$ 450,253	$ 3,033			$ 85,108	$ 6,936						$ 545,330	$ 63,728
45	$ 470,514		$ 27,423		$ 88,938		$ 165,260					$ 752,135	$ 83,710
46	$ 491,687	$ 3,312			$ 92,940	$ 7,574						$ 595,514	$ 63,122
47	$ 513,813				$ 97,122							$ 610,936	$ 61,673
48	$ 536,935	$ 3,617			$ 101,493	$ 8,271						$ 650,316	$ 62,523
49	$ 561,097				$ 106,060							$ 667,157	$ 61,087
50	$ 586,346	$ 3,950	$ 34,174	$ 451,632	$ 110,833	$ 9,033	$ 205,944	$ 948,427		$ 2,113,637		$ 4,463,975	$ 389,275
													$ 6,517,920

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN SELECTED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

Clinton St OLS/RTC

1/12/2022 **v3.4.0** **21.72** **MG capacity**

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Total Cost [2]	Notes
Satellite Storage								
Land Acquisition	Acres	10.4	$ 100,000	$ 1,041,631	$ -	$ -	$ 1,041,631	Assumed equal to site clearing area. Parcel is COB-owned
Survey & Stake-out	LS	1	$ 36,450	$ 36,450	$ -	$ -	$ 36,450	
Site Clearing	SF	453,736	$ 3	$ 1,225,088	$ -	$ -	$ 1,225,088	SF of tank + 25%
Excavation	CY	193,258	$ 30	$ 5,797,741	$ -	$ -	$ 5,797,741	
Rock Excavation	CY	0	$ 200	$ -	$ -	$ -	$ -	
Piles / Foundation	LS	1	$ 1,000,000	$ 1,000,000	$ -	$ -	$ 1,000,000	
Bedding	CY	33,610	$ 77	$ 2,587,977	$ -	$ -	$ 2,587,977	
Structural Concrete	CY	55,747	$ 1,200	$ 66,896,507	$ -	$ -	$ 66,896,507	Floor:wall ratio requires less formwork and lowers unit cost
Site Dewatering and Erosion Control	LS	1		$ -	$ 675,000	$ 675,000	$ 675,000	
Sheeting/Bracing	SF	36,466	$ 46	$ 1,677,418	$ -	$ -	$ 1,677,418	
Backfill	CY	85,706	$ 44	$ 3,771,052	$ -	$ -	$ 3,771,052	
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
Cleaning Equipment	LF	300	$ 4,500	$ 1,350,000	$ -	$ -	$ 1,350,000	Tipping buckets price per Koester
Access Manholes	EA	3	$ 3,100	$ 9,300	$ -	$ -	$ 9,300	
Miscellaneous Site Restoration	LS	1	$ 200,000	$ 200,000	$ -	$ -	$ 200,000	
Grass Restoration	SY	50,415	$ 9	$ 453,736	$ -	$ -	$ 453,736	Assumed equal to site clearing quantity
Satellite Storage Conveyance 1 / Connection to OLS								
Excavation	CY	1,450	$ 30	$ 43,512	$ -	$ -	$ 43,512	
Bedding	CY	64	$ 77	$ 4,928	$ -	$ -	$ 4,928	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	8,702	$ 46	$ 400,308	$ -	$ -	$ 400,308	
Backfill	CY	1,450	$ 44	$ 63,817	$ -	$ -	$ 63,817	Assumed to be the same as volume excavated
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
6 ft Concrete Pipe	LF	378	$ 1,000	$ 378,363	$ -	$ -	$ 378,363	
Cut Access into Main Interceptor	LS	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	2	$ 3,100	$ 6,200	$ -	$ -	$ 6,200	
Satellite Storage Conveyance 2								
Excavation	CY	1,227	$ 30	$ 36,813	$ -	$ -	$ 36,813	
Bedding	CY	54	$ 77	$ 4,158	$ -	$ -	$ 4,158	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	11,044	$ 46	$ 508,016	$ -	$ -	$ 508,016	
Backfill	CY	1,227	$ 44	$ 53,992	$ -	$ -	$ 53,992	Assumed to be the same as volume excavated
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
3 ft Concrete Pipe	LF	480	$ 500	$ 240,083	$ -	$ -	$ 240,083	
Cut Access into Main Interceptor	EA	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	2	$ 3,100	$ 5,954	$ -	$ -	$ 5,954	
Inlet and Outlet Gates								
6 ft Diameter RTC Gate	EA	1	$ 150,000	$ 150,000	$ -	$ -	$ 150,000	
4 ft Diameter RTC Gate	EA	1	$ 100,000	$ 100,000	$ -	$ -	$ 100,000	
Inlet Weir	EA	1	$ 50,000	$ 50,000	$ -	$ -	$ 50,000	

Subtotal	**$**	**89,000,000**
Electrical, Controls and Instrumentation (15%)	**$**	**13,400,000**
Utility Relocation / Coordination (5%)	**$**	**4,500,000**
MPT (5%)	**$**	**4,500,000**
General Conditions, Bonds & Insurance (5% of Subtotal)	**$**	**5,600,000**
Base Probable Construction Cost (Rounded)	**$**	**117,000,000**
Contingency (40%)	**$**	**46,800,000**
Total Probable Construction Cost	**$**	**163,800,000**
Total Probable Construction Cost per Gallon	**$**	**7.54**

(1) For items without installation cost, installation cost is included in material price.
(2) Year 2022 dollars. Does not include engineering, administrative, and legal costs or contingency.

CSO033_2 Clinton St - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Gravity Dewatering

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Gravity Dewatering					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Water for Tipping Buckets	140.36	1000 cft	$ 22.83	$ 3,205	Assumes anticipated no. activations x 100 gal/ft of tipping bucket x length of tipping buckets
	4	quarter	$ 399.20	$ 1,597	$399.20 quarterly for 2" connection (specs mention 2" solenoid valve so flushing line is assumed to have that diameter)
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	1 millwright (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 37.31	$ 3,880	1 millwright's helper (1.5 x wage to capture fringe benefits) @ 2 hours per week
	26	hr	$ 43.73	$ 1,137	2 instrument techs @ 0.25 hour per week
Annual Maintenance Labor (clean tank)	160	hr	$ 45.00	$ 7,200	2 Vactor Crews: 2 EOs @ 5 days per year
	240	hr	$ 42.00	$ 10,080	2 ERC Crews: 3 SCW @ 5 days per year
ANNUAL LABOR AND UTILITY TOTAL				$ 34,845	
Millwright's Truck	104	hour	$ 20.00	$ 2,080	1 Millwright's Truck ($150,000, 5 year life) @ 104 hours per year (weekly check) rounded to $20/hr
ERC Truck	1	week	$ 1,153.85	$ 1,154	2 ERC Truck ($150,000, 5 year life) @ 1 week per year (annual maintenance)
Vactor Truck	1	week	$ 6,410.26	$ 6,410	2 Vactor Trucks ($500K each, 3 year life) @ 1 work week per year
Skid Steer	1	week	$ 346.15	$ 346	2 Skid Steers ($45K each, 5 year life) @ 1 work week per year
Lubricants / Misc. Supplies	1	LS	$ 500.00	$ 500	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 10,490	
				Total Cost	
Rehabilitation Expenses					
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Cleaning Equipment Replacement (every 20 years)	1	LS	$ 1,350,000.00	$ 1,350,000	May also require crane
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Misc Metal Replacement (at year 25)	1	LS	$ 50,000.00	$ 50,000	Grating, railing, hatches

CSO033_2 Clinton St - OLS Tank with Gravity Dewatering

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

	Tank Operation and Maintenance									
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Annual Parts Cost (Prev. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (20 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0										
1	$ 36,413				$ 10,962				$ 47,376	$ 45,120
2	$ 38,052				$ 11,456				$ 49,508	$ 44,905
3	$ 39,764				$ 11,971				$ 51,735	$ 44,691
4	$ 41,554				$ 12,510				$ 54,063	$ 44,478
5	$ 43,424				$ 13,073	$ 18,693			$ 75,189	$ 58,913
6	$ 45,378				$ 13,661				$ 59,039	$ 44,056
7	$ 47,420				$ 14,276				$ 61,695	$ 43,846
8	$ 49,554				$ 14,918				$ 64,472	$ 43,637
9	$ 51,783				$ 15,590				$ 67,373	$ 43,429
10	$ 54,114				$ 16,291	$ 23,295			$ 93,699	$ 57,523
11	$ 56,549				$ 17,024				$ 73,573	$ 43,017
12	$ 59,093				$ 17,790				$ 76,884	$ 42,812
13	$ 61,753				$ 18,591				$ 80,343	$ 42,608
14	$ 64,532				$ 19,427				$ 83,959	$ 42,405
15	$ 67,435				$ 20,302	$ 29,029			$ 116,766	$ 56,167
16	$ 70,470				$ 21,215				$ 91,685	$ 42,002
17	$ 73,641				$ 22,170				$ 95,811	$ 41,802
18	$ 76,955				$ 23,168				$ 100,123	$ 41,603
19	$ 80,418				$ 24,210				$ 104,628	$ 41,405
20	$ 84,037				$ 25,299	$ 36,176	$ 3,255,814		$ 3,401,326	$ 1,281,924
21	$ 87,819				$ 26,438				$ 114,257	$ 41,012
22	$ 91,770				$ 27,628				$ 119,398	$ 40,816
23	$ 95,900				$ 28,871				$ 124,771	$ 40,622
24	$ 100,216				$ 30,170				$ 130,386	$ 40,428
25	$ 104,725			$ 150,272	$ 31,528	$ 45,082		$ 150,272	$ 481,878	$ 142,300
26	$ 109,438				$ 32,947				$ 142,384	$ 40,044
27	$ 114,363				$ 34,429				$ 148,792	$ 39,854
28	$ 119,509				$ 35,978				$ 155,487	$ 39,664
29	$ 124,887				$ 37,597				$ 162,484	$ 39,475
30	$ 130,507				$ 39,289	$ 56,180			$ 225,976	$ 52,286
31	$ 136,380				$ 41,057				$ 177,437	$ 39,100
32	$ 142,517				$ 42,905				$ 185,422	$ 38,914
33	$ 148,930				$ 44,836				$ 193,766	$ 38,728
34	$ 155,632				$ 46,853				$ 202,485	$ 38,544
35	$ 162,635				$ 48,962	$ 70,010			$ 281,607	$ 51,053
36	$ 169,954				$ 51,165				$ 221,119	$ 38,178
37	$ 177,602				$ 53,467				$ 231,069	$ 37,996
38	$ 185,594				$ 55,873				$ 241,467	$ 37,815
39	$ 193,945				$ 58,388				$ 252,333	$ 37,635
40	$ 202,673				$ 61,015	$ 87,245	$ 7,852,092		$ 8,203,026	$ 1,165,204
41	$ 211,793				$ 63,761				$ 275,554	$ 37,277
42	$ 221,324				$ 66,630				$ 287,954	$ 37,100
43	$ 231,283				$ 69,628				$ 300,912	$ 36,923
44	$ 241,691				$ 72,762				$ 314,453	$ 36,747
45	$ 252,567				$ 76,036	$ 108,724			$ 437,327	$ 48,673
46	$ 263,933				$ 79,458				$ 343,390	$ 36,398
47	$ 275,810				$ 83,033				$ 358,843	$ 36,225
48	$ 288,221				$ 86,770				$ 374,991	$ 36,052
49	$ 301,191				$ 90,674				$ 391,866	$ 35,881
50	$ 314,745			$ 451,632	$ 94,755	$ 135,490		$ 451,632	$ 1,448,253	$ 126,293
										$ 4,653,580

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN SELECTED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

SPP336B OLS (Sidney OLS)

1/17/2022 **v3.4.0** **2.62** **MG**

Description	Material				Installation [1]		Total Cost [2]	Notes
	Basis	No. Units	Per Unit	Subtotal	Per Unit	Subtotal		
Satellite Storage								
Land Acquisition	Acres	0.5	$ 100,000	$ 50,218	$ -	$ -	$ 50,218	Assumed equal to site clearing quantity. COB perfecting title
Survey & Stake-out	LS	1	$ 36,450	$ 36,450	$ -	$ -	$ 36,450	
Site Clearing	SF	21,875	$ 3	$ 59,063	$ -	$ -	$ 59,063	SF of tank + 25%
Excavation	CY	8,912	$ 30	$ 267,361	$ -	$ -	$ 267,361	
Rock Excavation	CY	22,280	$ 200	$ 4,456,019	$ -	$ -	$ 4,456,019	
Piles / Foundation	LS		$ 500,000	$ -	$ -	$ -	$ -	Piles not needed on bedrock
Bedding	CY	1,620	$ 77	$ 124,769	$ -	$ -	$ 124,769	
Structural Concrete	CY	2,990	$ 1,200	$ 3,588,016	$ -	$ -	$ 3,588,016	
Site Dewatering and Erosion Control	LS	1		$ -	$ 675,000	$ 675,000	$ 675,000	
Sheeting/Bracing	SF	21,425	$ 46	$ 985,562	$ -	$ -	$ 985,562	
Backfill	CY	18,229	$ 44	$ 802,083	$ -	$ -	$ 802,083	
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
Cleaning Equipment	LF	125	$ 4,500	$ 562,500	$ -	$ -	$ 562,500	Tipping buckets price per Koester
Access Manholes	EA	3	$ 3,100	$ 9,300	$ -	$ -	$ 9,300	
Miscellaneous Site Restoration	LS	1	$ 200,000	$ 200,000	$ -	$ -	$ 200,000	Misc site and pipe trench restoration
Grass Restoration	SY	2,431	$ 9	$ 21,875	$ -	$ -	$ 21,875	Assumed equal to site clearing quantity
Satellite Storage Conveyance 1 / Connection to OLS								
Excavation	CY	2,073	$ 30	$ 62,203	$ -	$ -	$ 62,203	
Bedding	CY	27	$ 77	$ 2,079	$ -	$ -	$ 2,079	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	15,995	$ 46	$ 735,769	$ -	$ -	$ 735,769	
Backfill	CY	2,073	$ 44	$ 91,231	$ -	$ -	$ 91,231	Equals excavation volume
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed included in excavation costs
4 ft Concrete Pipe	LF	208	$ 800	$ 166,182	$ -	$ -	$ 166,182	
Cut Access into Main Interceptor	LS	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	1	$ 3,100	$ 3,100	$ -	$ -	$ 3,100	
Satellite Storage Conveyance 2 / OLS Effluent to Collection System								
Excavation	CY	2,963	$ 30	$ 88,888	$ -	$ -	$ 88,888	
Bedding	CY	39	$ 77	$ 3,003	$ -	$ -	$ 3,003	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	26,666	$ 46	$ 1,226,658	$ -	$ -	$ 1,226,658	
Backfill	CY	2,963	$ 44	$ 130,369	$ -	$ -	$ 130,369	Equals excavation volume
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed included in excavation costs
3 ft Concrete Pipe	LF	346	$ 500	$ 173,159	$ -	$ -	$ 173,159	
Cut Access into Main Interceptor	EA	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	2	$ 3,100	$ 6,200	$ -	$ -	$ 6,200	
Inlet and Outlet Gates								
4 ft Diameter Inlet and Outlet Gate	EA	2	$ 100,000	$ 200,000	$ -	$ -	$ 200,000	Broadway Oak RTC gates $100,000 each
			$ -	$ -	$ -	$ -	$ -	

Subtotal	**$**	**15,000,000**
Electrical, Controls and Instrumentation (15%)	**$**	**2,300,000**
Utility Relocation / Coordination (5%)	**$**	**800,000**
MPT (5%)	**$**	**800,000**
General Conditions, Bonds & Insurance (5% of Subtotal)	**$**	**900,000**
Base Probable Construction Cost (Rounded)	**$**	**19,800,000**
Contingency (40%)	**$**	**7,920,000**
Total Probable Construction Cost	**$**	**27,720,000**
Total Probable Construction Cost per Gallon	**$**	**10.58**

(1) For items without installation cost, installation cost is included in material price

(2) Year 2022 dollars. Does not include engineering, administrative, and legal costs or contingency

CSO053_1.4 - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Gravity Dewatering

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Gravity Dewatering					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Water for Tipping Buckets	68.51	1000 cft	$ 22.83	$ 1,564	Assumes anticipated no. activations x 100 gal/ft of tipping bucket x length of tipping buckets
	4	quarter	$ 399.20	$ 1,597	$399.20 quarterly for 2" connection (specs mention 2" solenoid valve so flushing line is assumed to have that diameter)
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	1 millwright (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 37.31	$ 3,880	1 millwright's helper (1.5 x wage to capture fringe benefits) @ 2 hours per week
	26	hr	$ 43.73	$ 1,137	2 instrument techs @ 0.25 hour per week
Annual Maintenance Labor (clean tank)	160	hr	$ 45.00	$ 7,200	2 Vactor Crews: 2 EOs @ 5 days per year
	240	hr	$ 42.00	$ 10,080	2 ERC Crews: 3 SCW @ 5 days per year
ANNUAL LABOR AND UTILITY TOTAL				$ 33,205	
Millwright's Truck	104	hour	$ 20.00	$ 2,080	1 Millwright's Truck ($150,000, 5 year life) @ 104 hours per year (weekly check) rounded to $20/hr
ERC Truck	1	week	$ 1,153.85	$ 1,154	2 ERC Truck ($150,000, 5 year life) @ 1 week per year (annual maintenance)
Vactor Truck	1	week	$ 6,410.26	$ 6,410	2 Vactor Trucks ($500K each, 3 year life) @ 1 work week per year
Skid Steer	1	week	$ 346.15	$ 346	2 Skid Steers ($45K each, 5 year life) @ 1 work week per year
Lubricants / Misc. Supplies	1	LS	$ 500.00	$ 500	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 10,490	
				Total Cost	
Rehabilitation Expenses					
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Cleaning Equipment Replacement (every 20 years)	1	LS	$ 562,500.00	$ 562,500	May also require crane
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Misc Metal Replacement (at year 25)	1	LS	$ 50,000.00	$ 50,000	Grating, railing, hatches

CSO053_1.4 - OLS Tank with Gravity Dewatering

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

	Tank Operation and Maintenance									
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Annual Parts Cost (Prev. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (20 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0										
1	$ 34,699				$ 10,962				$ 45,661	$ 43,487
2	$ 36,261				$ 11,456				$ 47,716	$ 43,280
3	$ 37,892				$ 11,971				$ 49,863	$ 43,074
4	$ 39,597				$ 12,510				$ 52,107	$ 42,869
5	$ 41,379				$ 13,073	$ 18,693			$ 73,145	$ 57,311
6	$ 43,241				$ 13,661				$ 56,902	$ 42,461
7	$ 45,187				$ 14,276				$ 59,463	$ 42,259
8	$ 47,221				$ 14,918				$ 62,139	$ 42,058
9	$ 49,346				$ 15,590				$ 64,935	$ 41,858
10	$ 51,566				$ 16,291	$ 23,295			$ 91,152	$ 55,959
11	$ 53,887				$ 17,024				$ 70,911	$ 41,460
12	$ 56,312				$ 17,790				$ 74,102	$ 41,263
13	$ 58,846				$ 18,591				$ 77,436	$ 41,066
14	$ 61,494				$ 19,427				$ 80,921	$ 40,871
15	$ 64,261				$ 20,302	$ 29,029			$ 113,592	$ 54,640
16	$ 67,153				$ 21,215				$ 88,368	$ 40,482
17	$ 70,174				$ 22,170				$ 92,344	$ 40,290
18	$ 73,332				$ 23,168				$ 96,500	$ 40,098
19	$ 76,632				$ 24,210				$ 100,842	$ 39,907
20	$ 80,081				$ 25,299	$ 36,176	$ 1,356,589		$ 1,498,145	$ 564,635
21	$ 83,684				$ 26,438				$ 110,122	$ 39,528
22	$ 87,450				$ 27,628				$ 115,078	$ 39,339
23	$ 91,385				$ 28,871				$ 120,256	$ 39,152
24	$ 95,498				$ 30,170				$ 125,668	$ 38,966
25	$ 99,795			$ 150,272	$ 31,528	$ 45,082		$ 150,272	$ 476,948	$ 140,844
26	$ 104,286				$ 32,947				$ 137,232	$ 38,595
27	$ 108,979				$ 34,429				$ 143,408	$ 38,412
28	$ 113,883				$ 35,978				$ 149,861	$ 38,229
29	$ 119,008				$ 37,597				$ 156,605	$ 38,047
30	$ 124,363				$ 39,289	$ 56,180			$ 219,832	$ 50,864
31	$ 129,959				$ 41,057				$ 171,017	$ 37,685
32	$ 135,807				$ 42,905				$ 178,712	$ 37,506
33	$ 141,919				$ 44,836				$ 186,754	$ 37,327
34	$ 148,305				$ 46,853				$ 195,158	$ 37,149
35	$ 154,979				$ 48,962	$ 70,010			$ 273,951	$ 49,665
36	$ 161,953				$ 51,165				$ 213,118	$ 36,796
37	$ 169,241				$ 53,467				$ 222,708	$ 36,621
38	$ 176,856				$ 55,873				$ 232,730	$ 36,447
39	$ 184,815				$ 58,388				$ 243,203	$ 36,273
40	$ 193,132				$ 61,015	$ 87,245	$ 3,271,705		$ 3,613,097	$ 513,225
41	$ 201,823				$ 63,761				$ 265,583	$ 35,929
42	$ 210,905				$ 66,630				$ 277,535	$ 35,757
43	$ 220,395				$ 69,628				$ 290,024	$ 35,587
44	$ 230,313				$ 72,762				$ 303,075	$ 35,418
45	$ 240,677				$ 76,036	$ 108,724			$ 425,437	$ 47,350
46	$ 251,508				$ 79,458				$ 330,965	$ 35,081
47	$ 262,826				$ 83,033				$ 345,859	$ 34,914
48	$ 274,653				$ 86,770				$ 361,422	$ 34,748
49	$ 287,012				$ 90,674				$ 377,686	$ 34,582
50	$ 299,928			$ 451,632	$ 94,755	$ 135,490		$ 451,632	$ 1,433,435	$ 125,001
										$ 3,214,370

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate) ^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate) ^{Year} = $F / (1 + i)^n$

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN SELECTED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

Edison Martha OLS

1/17/2022 **v3.4.0** **2.61** **MG**

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Total Cost [2]	Notes
Satellite Storage								
Land Acquisition	Acres	1.3	$ 100,000	$ 125,307	$ -	$ -	$ 125,307	Assumed equal to site clearing quantity. COB-owned (Roosevelt Park)
Survey & Stake-out	LS	1	$ 36,450	$ 36,450	$ -	$ -	$ 36,450	
Site Clearing	SF	54,584	$ 3	$ 147,376	$ -	$ -	$ 147,376	SF of tank + 25%
Excavation	CY	40,432	$ 30	$ 1,212,972	$ -	$ -	$ 1,212,972	
Rock Excavation	CY	4,488	$ 200	$ 897,599		$ -	$ 897,599	
Piles / Foundation	LS		$ 500,000	$ -		$ -	$ -	Piles not needed on bedrock
Bedding	CY	4,043	$ 77	$ 311,330	$ -	$ -	$ 311,330	
Structural Concrete	CY	6,876	$ 1,600	$ 11,001,031	$ -	$ -	$ 11,001,031	
Site Dewatering and Erosion Control	LS	1		$ -	$ 675,000	$ 675,000	$ 675,000	
Sheeting/Bracing	SF	21,740	$ 46	$ 1,000,032		$ -	$ 1,000,032	
Backfill	CY	31,982	$ 44	$ 1,407,210		$ -	$ 1,407,210	
Hauling	CY	0	$ 14	$ -		$ -	$ -	Hauling and disposal rolled into excavation costs
Cleaning Equipment	LF	130	$ 4,500	$ 585,000	$ -	$ -	$ 585,000	Tipping buckets price per Koester
Access Manholes	EA	3	$ 3,100	$ 9,300	$ -	$ -	$ 9,300	
Miscellaneous Site Restoration	LS	1	$ 200,000	$ 200,000		$ -	$ 200,000	Misc site and pipe trench restoration
Grass Restoration	SY	6,065	$ 9	$ 54,584	$ -	$ -	$ 54,584	Assumed equal to site clearing quantity
Satellite Storage Conveyance 1 / Connection to OLS								
Excavation	CY	1,349	$ 30	$ 40,477	$ -	$ -	$ 40,477	
Bedding	CY	31	$ 77	$ 2,387	$ -	$ -	$ 2,387	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	14,572	$ 46	$ 670,292	$ -	$ -	$ 670,292	
Backfill	CY	1,349	$ 44	$ 59,366	$ -	$ -	$ 59,366	Assumed to be the same as volume excavatec
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
4 ft Concrete Pipe	LF	328	$ 800	$ 262,314	$ -	$ -	$ 262,314	
Cut Access into Main Interceptor	LS	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	2	$ 3,100	$ 6,200	$ -	$ -	$ 6,200	
Satellite Storage Conveyance 2 / OLS Effluent to Collection System								
Excavation	CY	1,654	$ 30	$ 49,610	$ -	$ -	$ 49,610	
Bedding	CY	38	$ 77	$ 2,926	$ -	$ -	$ 2,926	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	17,859	$ 46	$ 821,535	$ -	$ -	$ 821,535	
Backfill	CY	1,654	$ 44	$ 72,761	$ -	$ -	$ 72,761	Assumed to be the same as volume excavatec
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
2 ft Concrete Pipe	LF	402	$ 450	$ 180,845	$ -	$ -	$ 180,845	
Cut Access into Main Interceptor	EA	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	2	$ 3,100	$ 6,200	$ -	$ -	$ 6,200	
Inlet and Outlet Gates								
4 ft Inlet RTC Gate	EA	1	$ 100,000	$ 100,000	$ -	$ -	$ 100,000	Broadway Oak RTC gates $100,000 each
2 ft Outlet RTC Gate	EA	1	$ 60,000	$ 60,000	$ -	$ -	$ 60,000	

Subtotal	**$**	**20,300,000**
Electrical, Controls and Instrumentation (15%)	**$**	**3,000,000**
Utility Relocation / Coordination (5%)	**$**	**1,000,000**
MPT (5%)	**$**	**1,000,000**
General Conditions, Bonds & Insurance (5% of Subtotal)	**$**	**1,300,000**
Base Probable Construction Cost (Rounded)	**$**	**26,600,000**
Contingency (40%)	**$**	**10,640,000**
Total Probable Construction Cost	**$**	**37,240,000**
Total Probable Construction Cost per Gallon	**$**	**14.27**

(1) For items without installation cost, installation cost is included in material price

(2) Year 2022 dollars. Does not include engineering, administrative, and legal costs or contingency

CSO053_5.2 Edison Martha - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Gravity Dewatering

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Gravity Dewatering					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Water for Tipping Buckets	59.09	1000 cft	$ 22.83	$ 1,349	Assumes anticipated no. activations x 100 gal/ft of tipping bucket x length of tipping buckets
	4	quarter	$ 399.20	$ 1,597	$399.20 quarterly for 2" connection (specs mention 2" solenoid valve so flushing line is assumed to have that diameter)
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	1 millwright (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 37.31	$ 3,880	1 millwright's helper (1.5 x wage to capture fringe benefits) @ 2 hours per week
	26	hr	$ 43.73	$ 1,137	2 instrument techs @ 0.25 hour per week
Annual Maintenance Labor (clean tank)	160	hr	$ 45.00	$ 7,200	2 Vactor Crews: 2 EOs @ 5 days per year
	240	hr	$ 42.00	$ 10,080	2 ERC Crews: 3 SCW @ 5 days per year
ANNUAL LABOR AND UTILITY TOTAL				$ 32,990	
Millwright's Truck	104	hour	$ 20.00	$ 2,080	1 Millwright's Truck ($150,000, 5 year life) @ 104 hours per year (weekly check) rounded to $20/hr
ERC Truck	1	week	$ 1,153.85	$ 1,154	2 ERC Truck ($150,000, 5 year life) @ 1 week per year (annual maintenance)
Vactor Truck	1	week	$ 6,410.26	$ 6,410	2 Vactor Trucks ($500K each, 3 year life) @ 1 work week per year
Skid Steer	1	week	$ 346.15	$ 346	2 Skid Steers ($45K each, 5 year life) @ 1 work week per year
Lubricants / Misc. Supplies	1	LS	$ 500.00	$ 500	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 10,490	
				Total Cost	
Rehabilitation Expenses					
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Cleaning Equipment Replacement (every 20 years)	1	LS	$ 585,000.00	$ 585,000	May also require crane
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Misc Metal Replacement (at year 25)	1	LS	$ 50,000.00	$ 50,000	Grating, railing, hatches

CSO053_5.2 Edison Martha - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Gravity Dewatering

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

	Tank Operation and Maintenance									
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Annual Parts Cost (Prev. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (20 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0										
1	$ 34,474				$ 10,962				$ 45,437	$ 43,273
2	$ 36,026				$ 11,456				$ 47,481	$ 43,067
3	$ 37,647				$ 11,971				$ 49,618	$ 42,862
4	$ 39,341				$ 12,510				$ 51,851	$ 42,658
5	$ 41,111				$ 13,073	$ 18,693			$ 72,877	$ 57,101
6	$ 42,961				$ 13,661				$ 56,622	$ 42,252
7	$ 44,894				$ 14,276				$ 59,170	$ 42,051
8	$ 46,915				$ 14,918				$ 61,833	$ 41,851
9	$ 49,026				$ 15,590				$ 64,615	$ 41,652
10	$ 51,232				$ 16,291	$ 23,295			$ 90,818	$ 55,754
11	$ 53,537				$ 17,024				$ 70,562	$ 41,256
12	$ 55,947				$ 17,790				$ 73,737	$ 41,059
13	$ 58,464				$ 18,591				$ 77,055	$ 40,864
14	$ 61,095				$ 19,427				$ 80,523	$ 40,669
15	$ 63,844				$ 20,302	$ 29,029			$ 113,175	$ 54,439
16	$ 66,717				$ 21,215				$ 87,933	$ 40,283
17	$ 69,720				$ 22,170				$ 91,890	$ 40,091
18	$ 72,857				$ 23,168				$ 96,025	$ 39,900
19	$ 76,136				$ 24,210				$ 100,346	$ 39,710
20	$ 79,562				$ 25,299	$ 36,176	$ 1,410,853		$ 1,551,890	$ 584,891
21	$ 83,142				$ 26,438				$ 109,580	$ 39,333
22	$ 86,883				$ 27,628				$ 114,511	$ 39,146
23	$ 90,793				$ 28,871				$ 119,664	$ 38,959
24	$ 94,879				$ 30,170				$ 125,049	$ 38,774
25	$ 99,148			$ 150,272	$ 31,528	$ 45,082		$ 150,272	$ 476,301	$ 140,653
26	$ 103,610				$ 32,947				$ 136,557	$ 38,405
27	$ 108,273				$ 34,429				$ 142,702	$ 38,222
28	$ 113,145				$ 35,978				$ 149,123	$ 38,040
29	$ 118,236				$ 37,597				$ 155,834	$ 37,859
30	$ 123,557				$ 39,289	$ 56,180			$ 219,026	$ 50,678
31	$ 129,117				$ 41,057				$ 170,174	$ 37,500
32	$ 134,927				$ 42,905				$ 177,832	$ 37,321
33	$ 140,999				$ 44,836				$ 185,835	$ 37,143
34	$ 147,344				$ 46,853				$ 194,197	$ 36,966
35	$ 153,975				$ 48,962	$ 70,010			$ 272,946	$ 49,483
36	$ 160,903				$ 51,165				$ 212,068	$ 36,615
37	$ 168,144				$ 53,467				$ 221,611	$ 36,441
38	$ 175,710				$ 55,873				$ 231,584	$ 36,267
39	$ 183,617				$ 58,388				$ 242,005	$ 36,095
40	$ 191,880				$ 61,015	$ 87,245	$ 3,402,573		$ 3,742,714	$ 531,636
41	$ 200,515				$ 63,761				$ 264,276	$ 35,752
42	$ 209,538				$ 66,630				$ 276,168	$ 35,581
43	$ 218,967				$ 69,628				$ 288,596	$ 35,412
44	$ 228,821				$ 72,762				$ 301,582	$ 35,243
45	$ 239,118				$ 76,036	$ 108,724			$ 423,877	$ 47,176
46	$ 249,878				$ 79,458				$ 329,336	$ 34,908
47	$ 261,123				$ 83,033				$ 344,156	$ 34,742
48	$ 272,873				$ 86,770				$ 359,643	$ 34,577
49	$ 285,152				$ 90,674				$ 375,827	$ 34,412
50	$ 297,984			$ 451,632	$ 94,755	$ 135,490		$ 451,632	$ 1,431,492	$ 124,831
										$ 3,243,860

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

CSO053_11 Canisius - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Gravity Dewatering

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Gravity Dewatering					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Water for Tipping Buckets	45.88	1000 cft	$ 22.83	$ 1,047	Assumes anticipated no. activations x 100 gal/ft of tipping bucket x length of tipping buckets
	4	quarter	$ 399.20	$ 1,597	$399.20 quarterly for 2" connection (specs mention 2" solenoid valve so flushing line is assumed to have that diameter)
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	1 millwright (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 37.31	$ 3,880	1 millwright's helper (1.5 x wage to capture fringe benefits) @ 2 hours per week
	26	hr	$ 43.73	$ 1,137	2 instrument techs @ 0.25 hour per week
Annual Maintenance Labor (clean tank)	160	hr	$ 45.00	$ 7,200	2 Vactor Crews: 2 EOs @ 5 days per year
	240	hr	$ 42.00	$ 10,080	2 ERC Crews: 3 SCW @ 5 days per year
ANNUAL LABOR AND UTILITY TOTAL				$ 32,688	
Millwright's Truck	104	hour	$ 20.00	$ 2,080	1 Millwright's Truck ($150,000, 5 year life) @ 104 hours per year (weekly check) rounded to $20/hr
ERC Truck	1	week	$ 1,153.85	$ 1,154	2 ERC Truck ($150,000, 5 year life) @ 1 week per year (annual maintenance)
Vactor Truck	1	week	$ 6,410.26	$ 6,410	2 Vactor Trucks ($500K each, 3 year life) @ 1 work week per year
Skid Steer	1	week	$ 346.15	$ 346	2 Skid Steers ($45K each, 5 year life) @ 1 work week per year
Lubricants / Misc. Supplies	1	LS	$ 500.00	$ 500	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 10,490	
				Total Cost	
Rehabilitation Expenses					
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Cleaning Equipment Replacement (every 20 years)	1	LS	$ 351,000.00	$ 351,000	Assumes 78 ft tank width and $4500/LF for tipping buckets. May also require crane
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Misc Metal Replacement (at year 25)	1	LS	$ 50,000.00	$ 50,000	Grating, railing, hatches

CSO053_11 Canisius - OLS Tank with Gravity Dewatering

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

	Tank Operation and Maintenance									
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Annual Parts Cost (Prev. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (20 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0										
1	$ 34,159				$ 10,962				$ 45,121	$ 42,973
2	$ 35,696				$ 11,456				$ 47,152	$ 42,768
3	$ 37,303				$ 11,971				$ 49,274	$ 42,565
4	$ 38,981				$ 12,510				$ 51,491	$ 42,362
5	$ 40,735				$ 13,073	$ 18,693			$ 72,501	$ 56,806
6	$ 42,569				$ 13,661				$ 56,230	$ 41,959
7	$ 44,484				$ 14,276				$ 58,760	$ 41,760
8	$ 46,486				$ 14,918				$ 61,404	$ 41,561
9	$ 48,578				$ 15,590				$ 64,167	$ 41,363
10	$ 50,764				$ 16,291	$ 23,295			$ 90,349	$ 55,467
11	$ 53,048				$ 17,024				$ 70,072	$ 40,970
12	$ 55,435				$ 17,790				$ 73,226	$ 40,775
13	$ 57,930				$ 18,591				$ 76,521	$ 40,581
14	$ 60,537				$ 19,427				$ 79,964	$ 40,387
15	$ 63,261				$ 20,302	$ 29,029			$ 112,592	$ 54,159
16	$ 66,108				$ 21,215				$ 87,323	$ 40,004
17	$ 69,082				$ 22,170				$ 91,252	$ 39,813
18	$ 72,191				$ 23,168				$ 95,359	$ 39,624
19	$ 75,440				$ 24,210				$ 99,650	$ 39,435
20	$ 78,835				$ 25,299	$ 36,176	$ 846,512		$ 986,821	$ 371,923
21	$ 82,382				$ 26,438				$ 108,820	$ 39,060
22	$ 86,089				$ 27,628				$ 113,717	$ 38,874
23	$ 89,963				$ 28,871				$ 118,834	$ 38,689
24	$ 94,012				$ 30,170				$ 124,182	$ 38,505
25	$ 98,242			$ 150,272	$ 31,528	$ 45,082		$ 150,272	$ 475,395	$ 140,385
26	$ 102,663				$ 32,947				$ 135,610	$ 38,139
27	$ 107,283				$ 34,429				$ 141,712	$ 37,957
28	$ 112,111				$ 35,978				$ 148,089	$ 37,777
29	$ 117,156				$ 37,597				$ 154,753	$ 37,597
30	$ 122,428				$ 39,289	$ 56,180			$ 217,897	$ 50,416
31	$ 127,937				$ 41,057				$ 168,994	$ 37,239
32	$ 133,694				$ 42,905				$ 176,599	$ 37,062
33	$ 139,710				$ 44,836				$ 184,546	$ 36,886
34	$ 145,997				$ 46,853				$ 192,851	$ 36,710
35	$ 152,567				$ 48,962	$ 70,010			$ 271,539	$ 49,227
36	$ 159,433				$ 51,165				$ 210,598	$ 36,361
37	$ 166,607				$ 53,467				$ 220,075	$ 36,188
38	$ 174,104				$ 55,873				$ 229,978	$ 36,016
39	$ 181,939				$ 58,388				$ 240,327	$ 35,844
40	$ 190,126				$ 61,015	$ 87,245	$ 2,041,544		$ 2,379,931	$ 338,059
41	$ 198,682				$ 63,761				$ 262,443	$ 35,504
42	$ 207,623				$ 66,630				$ 274,253	$ 35,335
43	$ 216,966				$ 69,628				$ 286,594	$ 35,166
44	$ 226,729				$ 72,762				$ 299,491	$ 34,999
45	$ 236,932				$ 76,036	$ 108,724			$ 421,692	$ 46,933
46	$ 247,594				$ 79,458				$ 327,052	$ 34,666
47	$ 258,736				$ 83,033				$ 341,769	$ 34,501
48	$ 270,379				$ 86,770				$ 357,149	$ 34,337
49	$ 282,546				$ 90,674				$ 373,220	$ 34,174
50	$ 295,261			$ 451,632	$ 94,755	$ 135,490		$ 451,632	$ 1,428,768	$ 124,594
										$ 2,824,460

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate) ^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate) ^{Year} = $F / (1 + i)^n$

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN SELECTED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

Military Rd OLS/Hertel OLS

1/10/2022 **v3.4.0** **11.55** **MG**

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Total Cost [2]	Notes
Satellite Storage								
Land Acquisition	Acres	2.2	$ 100,000	$ 221,550	$ -	$ -	$ 221,550	Assumed equal to site clearing area. COB-owned (PS 94)
Survey & Stake-out	LS	1	$ 36,450	$ 36,450	$ -	$ -	$ 36,450	
Site Clearing	SF	96,508	$ 3	$ 260,570	$ -	$ -	$ 260,570	SF of tank + 25%
Excavation	CY	89,359	$ 30	$ 2,680,764	$ -	$ -	$ 2,680,764	
Rock Excavation	CY	64,160	$ 200	$ 12,831,923		$ -	$ 12,831,923	
Piles / Foundation	LS	0	$ 500,000	$ -		$ -	$ -	Piles not needed on bedrock
Bedding	CY	7,149	$ 77	$ 550,450	$ -	$ -	$ 550,450	
Structural Concrete	CY	12,881	$ 1,600	$ 20,609,493	$ -	$ -	$ 20,609,493	
Site Dewatering and Erosion Control	LS	1		$ -	$ 675,000	$ 675,000	$ 675,000	
Sheeting/Bracing	SF	52,857	$ 46	$ 2,431,421		$ -	$ 2,431,421	
Backfill	CY	96,329	$ 44	$ 4,238,466		$ -	$ 4,238,466	
Hauling	CY	0	$ 14	$ -		$ -	$ -	Hauling and disposal rolled into excavation costs
Cleaning Equipment	LF	200	$ 4,500	$ 900,000	$ -	$ -	$ 900,000	Tipping buckets price per Koester
Access Manholes	EA	3	$ 3,100	$ 9,300	$ -	$ -	$ 9,300	
Miscellaneous Site Restoration	LS	0	$ 100,000	$ -		$ -	$ -	
Pavement Restoration	SF	96,508	$ 11	$ 1,061,583	$ -	$ -	$ 1,061,583	Assumed equal to site clearing quantity
Satellite Storage Conveyance 1 / Connection to OLS								
Excavation	CY	10,506	$ 30	$ 315,173	$ -	$ -	$ 315,173	
Bedding	CY	123	$ 77	$ 9,471	$ -	$ -	$ 9,471	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	56,731	$ 46	$ 2,609,631	$ -	$ -	$ 2,609,631	
Backfill	CY	10,506	$ 44	$ 462,253	$ -	$ -	$ 462,253	Assumed to be the same as volume excavated
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
7 ft Concrete Pipe	LF	660	$ 1,200	$ 792,518	$ -	$ -	$ 792,518	
Cut Access into Main Interceptor	LS	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	3	$ 3,100	$ 9,300	$ -	$ -	$ 9,300	
Inlet and Outlet Gates								
7 ft Inlet RTC Gate	EA	1	$ 175,000	$ 175,000	$ -	$ -	$ 175,000	
			$ -	$ -	$ -	$ -	$ -	
Satellite Storage Force Main								
Excavation	CY	5,982	$ 30	$ 179,454	$ -	$ -	$ 179,454	
Bedding	CY	70	$ 77	$ 5,390	$ -	$ -	$ 5,390	
Backfill	CY	5,982	$ 44	$ 263,199	$ -	$ -	$ 263,199	Assumed to be the same as volume excavated
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
Cut Access into Main Interceptor	EA	1	$ 13,500	$ 13,500	$ -	$ -	$ 13,500	
Pig Launcher	EA	1	$ 100,000	$ 100,000	$ -	$ -	$ 100,000	
20" ID Pipe	LF	806	$ 200	$ 161,148	$ -	$ -	$ 161,148	
Satellite Storage Pump Station								
Pumps	EA	2	$ 108,000	$ 216,000	$ 54,000	$ 108,000	$ 324,000	8.5 MGD dewatering capacity need noted in Xylem project list
Pump Station Building	SF	100	$ 2,000	$ 200,000		$ -	$ 200,000	
Piles / Foundation	LS	1	$ 100,000	$ 100,000		$ -	$ 100,000	
Piping in Tank (Including Bends)	LF	50	$ 500	$ 25,000		$ -	$ 25,000	
Check Valves	EA	2	$ 6,750	$ 13,500	$ 13,500	$ 27,000	$ 40,500	
Gate Valves	EA	2	$ 6,750	$ 13,500	$ 13,500	$ 27,000	$ 40,500	
Wet Well Isolation Gates	EA	2	$ 50,000	$ 100,000	$ 13,500	$ 27,000	$ 127,000	
Misc Metals (Grating, Handrail, Monorails, Etc.)	LS	1	$ 150,000	$ 150,000	$ -	$ -	$ 150,000	
Start-up and testing	LS	1	$ 13,500	$ 13,500	$ -	$ -	$ 13,500	

Subtotal	**$**	**52,800,000**
Electrical, Controls and Instrumentation (15%)	**$**	**7,900,000**
Utility Relocation / Coordination (5%)	**$**	**2,600,000**
MPT (5%)	**$**	**2,600,000**
General Conditions, Bonds & Insurance (5% of Subtotal)	**$**	**3,300,000**
Base Probable Construction Cost (Rounded)	**$**	**69,200,000**
Contingency (40%)	**$**	**27,680,000**
Total Probable Construction Cost	**$**	**96,880,000**
Total Probable Construction Cost per Gallon	**$**	**8.39**

(1) For items without installation cost, installation cost is included in material price.
(2) Year 2022 dollars. Does not include engineering, administrative, and legal costs or contingency.

CSO055_1.4 Military Rd - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Dewatering Pumps

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Dewatering Pumps					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Electrical Demands					
Dewatering Pumps (assumed 50 HP)	948	kWh	$ 0.14	$ 3,600	Based on activations per year, running 24 hours/activation, ME 85%, ML 90%
					Input kW = HP x Quantity x Motor Load (ML) x 0.746 / Motor Efficiency (ME)
Water for Tipping Buckets	72.19	1000 cft	$ 22.83	$ 1,648	Assumes anticipated no. activations x 100 gal/ft of tipping bucket x length of tipping buckets
	4	quarter	$ 399.20	$ 1,597	$399.20 quarterly for 2" connection (specs mention 2" solenoid valve so flushing line is assumed to have that diameter)
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	1 millwright (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 37.31	$ 3,880	1 millwright's helper (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 43.73	$ 4,547	2 instrument techs @ 1 hour per week
Biweekly Yards and Grounds Maintenance	104	hr	$ 33.00	$ 3,432	2 laborers @ 2 hrs biweekly
Quarterly Maintenance	64	hr	$ 43.73	$ 2,798	1 millwright @ 2 days per quarter
	64	hr	$ 37.31	$ 2,388	1 millwright's helper @ 2 days per quarter
	64	hr	$ 33.00	$ 2,112	1 laborer @ 2 days per quarter
Annual Maintenance Labor (clean tank / pigging FM)	160	hr	$ 45.00	$ 7,200	2 Vactor Crews: 2 EOs @ 5 days per year
	240	hr	$ 42.00	$ 10,080	2 ERC Crews: 3 SCW @ 5 days per year
Annual Property Maintenance	1	LS	$ 2,500.00	$ 2,500	Fence repair, landscaping upkeep
ANNUAL LABOR AND UTILITY TOTAL				$ 53,529	
Millwright's Truck	168	hour	$ 20.00	$ 3,360	1 Millwright's Truck ($150,000, 5 year life) @ 168 hours per year (weekly check plus quarterly maintenance) rounded to $20/hr
ERC Truck	1	week	$ 1,153.85	$ 1,154	2 ERC Truck ($150,000, 5 year life) @ 1 week per year (annual maintenance)
Vactor Truck	1	week	$ 6,410.26	$ 6,410	2 Vactor Trucks ($500K each, 3 year life) @ 1 work week per year
Skid Steer	1	week	$ 346.15	$ 346	2 Skid Steers ($45K each, 5 year life) @ 1 work week per year
Lubricants / Misc. Supplies	1	LS	$ 1,000.00	$ 1,000	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 12,270	
				Total Cost	
Rehabilitation Expenses					
Minor Pump Rehabilitation Labor (every 2 years)	10	hr	$ 43.73	$ 437	Assumes 5 hours for 2 millwrights
Minor Pump Rehabilitation Parts (every 2 years)	1	LS	$ 1,000.00	$ 1,000	Allowance for seals and other wearing parts.
Major Pump Rehabilitation Labor (every 5 years)	48	hr	$ 43.73	$ 2,099	3 days for 2 millwrights
Major Pump Rehabilitation Parts (every 5 years)	1	LS	$ 7,500.00	$ 7,500	Assumed centrifugal pump. Allowance for bearings, impellers, full pump end work.
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Electrical Replacement Parts (every 5 years)	1	LS	$ 300.00	$ 300	Breakers, relays
Minor Electrical De-Energized Maintenance and IR scans (every 5 years)	16	hr	$ 105.29	$ 1,685	1 day electrical maintenance (assuming breakers can be fully isolated for de-energized maintenance; no generator required). IR Scan 2 people, 1 day @ $105.29/hr.
PS Building Minor Maintenance (every 10 years)	1	LS	$ 5,000.00	$ 5,000	Painting, other property maintenance
PS HVAC Equipment Replacement (every 10 years)	1	LS	$ 100,000.00	$ 100,000	In line with Babcock PS
Cleaning Equipment Replacement (every 20 years)	1	LS	$ 900,000.00	$ 900,000	May also require crane
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Pump Replacement (at year 25)	1	LS	$ 324,000.00	$ 324,000	Includes motor
Misc Metal Replacement (at year 25)	1	LS	$ 50,000.00	$ 50,000	Grating, railing, hatches
MCC Cabinet Replacement (every 30 years)	1	LS	$ 10,000.00	$ 10,000	New buckets
PS Building Rehabilitation (every 30 years)	1	LS	$ 15,000.00	$ 15,000	Roof and window replacement

CSO055_1.4 Military Rd - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Dewatering Pumps

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

	Tank and Pump Maintenance														
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (10 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Labor Cost (30 yr. maint.)[1,2]	Annual Parts Cost (PM. maint.)[2]	Rehab Cost (2 yr. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (10 yr. maint.)[2]	Rehab Cost (20 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Rehab Cost (30 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0															
1	$ 55,938						$ 12,822							$ 68,761	$ 65,486
2	$ 58,455	$ 477					$ 13,399	$ 1,092						$ 73,424	$ 66,598
3	$ 61,086						$ 14,002							$ 75,088	$ 64,864
4	$ 63,835	$ 521					$ 14,633	$ 1,193						$ 80,181	$ 65,965
5	$ 66,707		$ 4,715				$ 15,291		$ 28,413					$ 115,126	$ 90,204
6	$ 69,709	$ 569					$ 15,979	$ 1,302						$ 87,560	$ 65,338
7	$ 72,846						$ 16,698							$ 89,544	$ 63,637
8	$ 76,124	$ 622					$ 17,450	$ 1,422						$ 95,617	$ 64,718
9	$ 79,550						$ 18,235							$ 97,784	$ 63,033
10	$ 83,129	$ 679	$ 5,876				$ 19,055	$ 1,553	$ 35,408	$ 163,062				$ 308,762	$ 189,553
11	$ 86,870						$ 19,913							$ 106,783	$ 62,434
12	$ 90,779	$ 742					$ 20,809	$ 1,696						$ 114,026	$ 63,494
13	$ 94,864						$ 21,745							$ 116,610	$ 61,841
14	$ 99,133	$ 810					$ 22,724	$ 1,852						$ 124,519	$ 62,890
15	$ 103,594		$ 7,322				$ 23,746		$ 44,124					$ 178,787	$ 86,000
16	$ 108,256	$ 884					$ 24,815	$ 2,022						$ 135,978	$ 62,293
17	$ 113,128						$ 25,932							$ 139,059	$ 60,671
18	$ 118,218	$ 966					$ 27,099	$ 2,208						$ 148,491	$ 61,701
19	$ 123,538						$ 28,318							$ 151,856	$ 60,095
20	$ 129,097	$ 1,055	$ 9,125				$ 29,592	$ 2,412	$ 54,987	$ 253,230	$ 2,170,543			$ 2,650,040	$ 998,772
21	$ 134,907						$ 30,924							$ 165,831	$ 59,524
22	$ 140,977	$ 1,152					$ 32,316	$ 2,634						$ 177,078	$ 60,534
23	$ 147,321						$ 33,770							$ 181,091	$ 58,958
24	$ 153,951	$ 1,258					$ 35,289	$ 2,876						$ 193,374	$ 59,959
25	$ 160,879		$ 11,371		$ 150,272		$ 36,877		$ 68,524			$ 1,124,032		$ 1,551,955	$ 458,297
26	$ 168,118	$ 1,373					$ 38,537	$ 3,141						$ 211,169	$ 59,389
27	$ 175,684						$ 40,271							$ 215,955	$ 57,843
28	$ 183,589	$ 1,500					$ 42,083	$ 3,430						$ 230,602	$ 58,825
29	$ 191,851						$ 43,977							$ 235,828	$ 57,294
30	$ 200,484	$ 1,638	$ 14,170				$ 45,956	$ 3,745	$ 85,393	$ 393,258			$ 93,633	$ 838,278	$ 193,959
31	$ 209,506						$ 48,024							$ 257,530	$ 56,749
32	$ 218,934	$ 1,788					$ 50,185	$ 4,090						$ 274,997	$ 57,713
33	$ 228,786						$ 52,443							$ 281,229	$ 56,210
34	$ 239,081	$ 1,953					$ 54,803	$ 4,466						$ 300,304	$ 57,164
35	$ 249,840		$ 17,659				$ 57,270		$ 106,416					$ 431,183	$ 78,169
36	$ 261,083	$ 2,133					$ 59,847	$ 4,877						$ 327,939	$ 56,621
37	$ 272,831						$ 62,540							$ 335,371	$ 55,147
38	$ 285,109	$ 2,329					$ 65,354	$ 5,326						$ 358,118	$ 56,083
39	$ 297,939						$ 68,295							$ 366,234	$ 54,623
40	$ 311,346	$ 2,543	$ 22,006				$ 71,368	$ 5,816	$ 132,613	$ 610,718	$ 5,234,728			$ 6,391,139	$ 907,834
41	$ 325,356						$ 74,580							$ 399,936	$ 54,104
42	$ 339,997	$ 2,777					$ 77,936	$ 6,352						$ 427,062	$ 55,023
43	$ 355,297						$ 81,443							$ 436,740	$ 53,590
44	$ 371,286	$ 3,033					$ 85,108	$ 6,936						$ 466,363	$ 54,500
45	$ 387,994		$ 27,423				$ 88,938		$ 165,260					$ 669,615	$ 74,526
46	$ 405,453	$ 3,312					$ 92,940	$ 7,574						$ 509,280	$ 53,982
47	$ 423,699						$ 97,122							$ 520,821	$ 52,576
48	$ 442,765	$ 3,617					$ 101,493	$ 8,271						$ 556,146	$ 53,469
49	$ 462,689						$ 106,060							$ 568,750	$ 52,077
50	$ 483,511	$ 3,950	$ 34,174		$ 451,632		$ 110,833	$ 9,033	$ 205,944	$ 948,427		$ 3,378,206		$ 5,625,709	$ 490,583
															$ 5,934,920

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_{cc}(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN SELECTED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

Schiller Park OLS

1/17/2022 **v3.4.0** **8.00** **MG**

Description	Material				Installation [1]		Total Cost [2]	Notes
	Basis	No. Units	Per Unit	Subtotal	Per Unit	Subtotal		
Satellite Storage								
Land Acquisition	Acres	3.1	$ 100,000	$ 306,909	$ -	$ -	$ 306,909	Assumed equal to site clearing quantity. COB-owned (Schiller Park)
Survey & Stake-out	LS	1	$ 36,450	$ 36,450	$ -	$ -	$ 36,450	
Site Clearing	SF	133,690	$ 3	$ 360,963	$ -	$ -	$ 360,963	SF of tank + 25%
Excavation	CY	99,030	$ 30	$ 2,970,889	$ -	$ -	$ 2,970,889	
Rock Excavation	CY	43,524	$ 200	$ 8,704,704	$ -	$ -	$ 8,704,704	
Piles / Foundation	LS	0	$ 500,000	$ -	$ -	$ -	$ -	Piles not needed on bedrock
Bedding	CY	9,903	$ 77	$ 762,528	$ -	$ -	$ 762,528	
Structural Concrete	CY	16,736	$ 1,200	$ 20,083,360	$ -	$ -	$ 20,083,360	
Site Dewatering and Erosion Control	LS	1		$ -	$ 675,000	$ 675,000	$ 675,000	
Sheeting/Bracing	SF	40,349	$ 46	$ 1,856,060	$ -	$ -	$ 1,856,060	
Backfill	CY	102,941	$ 44	$ 4,529,417	$ -	$ -	$ 4,529,417	
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
Cleaning Equipment	LF	267	$ 4,500	$ 1,203,210	$ -	$ -	$ 1,203,210	Tipping buckets price per Koester
Access Manholes	EA	3	$ 3,100	$ 9,300	$ -	$ -	$ 9,300	
Miscellaneous Site Restoration	LS	1	$ 200,000	$ 200,000	$ -	$ -	$ 200,000	to cover conveyance restoration
Grass Restoration	SY	14,854	$ 9	$ 133,690	$ -	$ -	$ 133,690	Assumed equal to site clearing quantity
Satellite Storage Conveyance 1 / Connection to OLS								
Excavation	CY	2,003	$ 30	$ 60,101	$ -	$ -	$ 60,101	
Bedding	CY	35	$ 77	$ 2,695	$ -	$ -	$ 2,695	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	15,454	$ 46	$ 710,906	$ -	$ -	$ 710,906	
Backfill	CY	2,003	$ 44	$ 88,148	$ -	$ -	$ 88,148	Assumed to be the same as volume excavatec
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
4 ft Concrete Pipe	LF	268	$ 800	$ 214,720	$ -	$ -	$ 214,720	
Cut Access into Main Interceptor	LS	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	2	$ 3,100	$ 6,200	$ -	$ -	$ 6,200	
Satellite Storage Conveyance 2								
Excavation	CY	6,535	$ 30	$ 196,041	$ -	$ -	$ 196,041	
Bedding	CY	114	$ 77	$ 8,778	$ -	$ -	$ 8,778	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	50,411	$ 46	$ 2,318,888	$ -	$ -	$ 2,318,888	Assumed to be the same as volume excavatec
Backfill	CY	6,535	$ 44	$ 287,527	$ -	$ -	$ 287,527	Assumed to be included with excavation
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
4 ft Concrete Pipe	LF	875	$ 800	$ 700,390	$ -	$ -	$ 700,390	
Cut Access into Main Interceptor	EA	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	4	$ 3,100	$ 12,400	$ -	$ -	$ 12,400	
Inlet and Outlet Gates								
4 ft Diameter Inlet Gate	EA	1	$ 100,000	$ 100,000	$ -	$ -	$ 100,000	Broadway Oak RTC gates $100,000 each
4 ft Diameter Outlet Gate	EA	1	$ 100,000	$ 100,000	$ -	$ -	$ 100,000	Broadway Oak RTC gates $100,000 each

Subtotal	**$**	**46,900,000**
Electrical, Controls and Instrumentation (15%)	**$**	**7,000,000**
Utility Relocation / Coordination (5%)	**$**	**2,300,000**
MPT (5%)	**$**	**2,300,000**
General Conditions, Bonds & Insurance (5% of Subtotal)	**$**	**2,900,000**
Base Probable Construction Cost (Rounded)	**$**	**61,400,000**
Contingency (40%)	**$**	**24,560,000**
Total Probable Construction Cost	**$**	**85,960,000**
Total Probable Construction Cost per Gallon	**$**	**10.75**

(1) For items without installation cost, installation cost is included in material price

(2) Year 2022 dollars. Does not include engineering, administrative, and legal costs or contingency

System_2 Schiller Park - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Gravity Dewatering

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Gravity Dewatering					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Water for Tipping Buckets	121.53	1000 cft	$ 22.83	$ 2,774	Assumes anticipated no. activations x 100 gal/ft of tipping bucket x length of tipping buckets
	4	quarter	$ 399.20	$ 1,597	$399.20 quarterly for 2" connection (specs mention 2" solenoid valve so flushing line is assumed to have that diameter)
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	1 millwright (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 37.31	$ 3,880	1 millwright's helper (1.5 x wage to capture fringe benefits) @ 2 hours per week
	26	hr	$ 43.73	$ 1,137	2 instrument techs @ 0.25 hour per week
Annual Maintenance Labor (clean tank)	160	hr	$ 45.00	$ 7,200	2 Vactor Crews: 2 EOs @ 5 days per year
	240	hr	$ 42.00	$ 10,080	2 ERC Crews: 3 SCW @ 5 days per year
ANNUAL LABOR AND UTILITY TOTAL				$ 34,415	
Millwright's Truck	104	hour	$ 20.00	$ 2,080	1 Millwright's Truck ($150,000, 5 year life) @ 104 hours per year (weekly check) rounded to $20/hr
ERC Truck	1	week	$ 1,153.85	$ 1,154	2 ERC Truck ($150,000, 5 year life) @ 1 week per year (annual maintenance)
Vactor Truck	1	week	$ 6,410.26	$ 6,410	2 Vactor Trucks ($500K each, 3 year life) @ 1 work week per year
Skid Steer	1	week	$ 346.15	$ 346	2 Skid Steers ($45K each, 5 year life) @ 1 work week per year
Lubricants / Misc. Supplies	1	LS	$ 500.00	$ 500	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 10,490	
				Total Cost	
Rehabilitation Expenses					
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Cleaning Equipment Replacement (every 20 years)	1	LS	$ 1,203,210.00	$ 1,203,210	May also require crane
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Misc Metal Replacement (at year 25)	1	LS	$ 50,000.00	$ 50,000	Grating, railing, hatches

System_2 Schiller Park - OLS Tank with Gravity Dewatering

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

	Tank Operation and Maintenance									
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Annual Parts Cost (Prev. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (20 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0										
1	$ 35,964				$ 10,962				$ 46,926	$ 44,692
2	$ 37,582				$ 11,456				$ 49,038	$ 44,479
3	$ 39,274				$ 11,971				$ 51,245	$ 44,267
4	$ 41,041				$ 12,510				$ 53,551	$ 44,056
5	$ 42,888				$ 13,073	$ 18,693			$ 74,653	$ 58,493
6	$ 44,818				$ 13,661				$ 58,479	$ 43,638
7	$ 46,834				$ 14,276				$ 61,110	$ 43,430
8	$ 48,942				$ 14,918				$ 63,860	$ 43,223
9	$ 51,144				$ 15,590				$ 66,734	$ 43,017
10	$ 53,446				$ 16,291	$ 23,295			$ 93,031	$ 57,113
11	$ 55,851				$ 17,024				$ 72,875	$ 42,609
12	$ 58,364				$ 17,790				$ 76,154	$ 42,406
13	$ 60,991				$ 18,591				$ 79,581	$ 42,204
14	$ 63,735				$ 19,427				$ 83,163	$ 42,003
15	$ 66,603				$ 20,302	$ 29,029			$ 115,934	$ 55,766
16	$ 69,600				$ 21,215				$ 90,816	$ 41,604
17	$ 72,732				$ 22,170				$ 94,902	$ 41,406
18	$ 76,005				$ 23,168				$ 99,173	$ 41,208
19	$ 79,426				$ 24,210				$ 103,636	$ 41,012
20	$ 83,000				$ 25,299	$ 36,176	$ 2,901,798		$ 3,046,273	$ 1,148,108
21	$ 86,735				$ 26,438				$ 113,173	$ 40,622
22	$ 90,638				$ 27,628				$ 118,265	$ 40,429
23	$ 94,716				$ 28,871				$ 123,587	$ 40,237
24	$ 98,979				$ 30,170				$ 129,149	$ 40,045
25	$ 103,433			$ 150,272	$ 31,528	$ 45,082		$ 150,272	$ 480,586	$ 141,918
26	$ 108,087				$ 32,947				$ 141,034	$ 39,664
27	$ 112,951				$ 34,429				$ 147,380	$ 39,476
28	$ 118,034				$ 35,978				$ 154,012	$ 39,288
29	$ 123,346				$ 37,597				$ 160,943	$ 39,101
30	$ 128,896				$ 39,289	$ 56,180			$ 224,365	$ 51,913
31	$ 134,696				$ 41,057				$ 175,754	$ 38,729
32	$ 140,758				$ 42,905				$ 183,663	$ 38,545
33	$ 147,092				$ 44,836				$ 191,928	$ 38,361
34	$ 153,711				$ 46,853				$ 200,564	$ 38,178
35	$ 160,628				$ 48,962	$ 70,010			$ 279,600	$ 50,689
36	$ 167,856				$ 51,165				$ 219,021	$ 37,816
37	$ 175,410				$ 53,467				$ 228,877	$ 37,636
38	$ 183,303				$ 55,873				$ 239,177	$ 37,456
39	$ 191,552				$ 58,388				$ 249,940	$ 37,278
40	$ 200,172				$ 61,015	$ 87,245	$ 6,998,308		$ 7,346,740	$ 1,043,573
41	$ 209,179				$ 63,761				$ 272,940	$ 36,924
42	$ 218,592				$ 66,630				$ 285,223	$ 36,748
43	$ 228,429				$ 69,628				$ 298,058	$ 36,573
44	$ 238,708				$ 72,762				$ 311,470	$ 36,399
45	$ 249,450				$ 76,036	$ 108,724			$ 434,210	$ 48,326
46	$ 260,676				$ 79,458				$ 340,133	$ 36,053
47	$ 272,406				$ 83,033				$ 355,439	$ 35,881
48	$ 284,664				$ 86,770				$ 371,434	$ 35,710
49	$ 297,474				$ 90,674				$ 388,148	$ 35,540
50	$ 310,860			$ 451,632	$ 94,755	$ 135,490		$ 451,632	$ 1,444,368	$ 125,954
										$ 4,379,800

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

BUFFALO SEWER AUTHORITY LONG TERM CONTROL PLAN SELECTED ALTERNATIVE
ENGINEER'S OPINION OF PROBABLE PROJECT COST

Bass Alley OLS

1/17/2022 **v3.4.0** **3.60** **MG**

Description	Basis	Material No. Units	Material Per Unit	Material Subtotal	Installation [1] Per Unit	Installation [1] Subtotal	Total Cost [2]	Notes
Satellite Storage								
Land Acquisition	Acres	0.4	$ 100,000	$ 39,569	$ -	$ -	$ 39,569	Assumed equal to site clearing quantity. COB-owned parcels.
Survey & Stake-out	LS	1	$ 36,450	$ 36,450	$ -	$ -	$ 36,450	
Site Clearing	SF	17,236	$ 3	$ 46,538	$ -	$ -	$ 46,538	SF of tank + 25%
Excavation	CY	6,384	$ 30	$ 191,514	$ -	$ -	$ 191,514	
Rock Excavation	CY	25,535	$ 200	$ 5,107,037	$ -	$ -	$ 5,107,037	
Piles / Foundation	LS	1	$ 500,000	$ 500,000	$ -	$ -	$ 500,000	
Bedding	CY	1,277	$ 77	$ 98,310	$ -	$ -	$ 98,310	
Structural Concrete	CY	3,320	$ 1,200	$ 3,983,738	$ -	$ -	$ 3,983,738	
Site Dewatering and Erosion Control	LS	1		$ -	$ 675,000	$ 675,000	$ 675,000	
Sheeting/Bracing	SF	7,166	$ 46	$ 329,648	$ -	$ -	$ 329,648	
Backfill	CY	14,044	$ 44	$ 617,951	$ -	$ -	$ 617,951	
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Hauling and disposal rolled into excavation costs
Cleaning Equipment	LF	133	$ 4,500	$ 596,250	$ -	$ -	$ 596,250	Tipping buckets price per Koester
Access Manholes	EA	3	$ 3,100	$ 9,300	$ -	$ -	$ 9,300	
Miscellaneous Site Restoration	LS	0	$ 100,000	$ -	$ -	$ -	$ -	
Pavement Restoration	SF	17,236	$ 11	$ 189,599	$ -	$ -	$ 189,599	Assumed equal to site clearing quantity
Satellite Storage Conveyance 1 / Connection to OLS								
Excavation	CY	3,813	$ 30	$ 114,401	$ -	$ -	$ 114,401	
Bedding	CY	39	$ 77	$ 3,003	$ -	$ -	$ 3,003	
Site Dewatering and Erosion Control	LS	1		$ -	$ 67,500	$ 67,500	$ 67,500	
Sheeting/Bracing	SF	34,320	$ 46	$ 1,578,738	$ -	$ -	$ 1,578,738	
Backfill	CY	3,813	$ 44	$ 167,789	$ -	$ -	$ 167,789	Assumed to be the same as volume excavated
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
3 ft Concrete Pipe	LF	343	$ 500	$ 171,602	$ -	$ -	$ 171,602	
Cut Access into Main Interceptor	LS	1	$ 67,500	$ 67,500	$ -	$ -	$ 67,500	
Manholes	EA	2	$ 3,100	$ 6,200	$ -	$ -	$ 6,200	
Inlet and Outlet Gates								
Outlet RTC Gate	EA	0	$ 10,000	$ -	$ -	$ -	$ -	
		0	$ -	$ -	$ -	$ -	$ -	
Satellite Storage Force Main								
Excavation	CY	2,750	$ 30	$ 82,485	$ -	$ -	$ 82,485	
Bedding	CY	28	$ 77	$ 2,156	$ -	$ -	$ 2,156	
Backfill	CY	2,750	$ 44	$ 120,978	$ -	$ -	$ 120,978	Assumed to be the same as volume excavated
Hauling	CY	0	$ 14	$ -	$ -	$ -	$ -	Assumed to be included with excavation
Cut Access into Main Interceptor	EA	1	$ 13,500	$ 13,500	$ -	$ -	$ 13,500	
Pig Launcher	EA	1	$ 75,000	$ 75,000	$ -	$ -	$ 75,000	
12" ID Pipe	LF	371	$ 174	$ 64,586	$ -	$ -	$ 64,586	
Satellite Storage Pump Station								
Pumps	EA	2	$ 65,000	$ 130,000	$ 27,000	$ 54,000	$ 184,000	3.6 MGD capacity needed
Pump Station Building	SF	100	$ 2,000	$ 200,000		$ -	$ 200,000	
Piles / Foundation	LS	1	$ 100,000	$ 100,000		$ -	$ 100,000	
Piping in Tank (Including Bends)	LF	50	$ 500	$ 25,000		$ -	$ 25,000	
Check Valves	EA	2	$ 6,750	$ 13,500	$ 13,500	$ 27,000	$ 40,500	
Gate Valves	EA	2	$ 6,750	$ 13,500	$ 13,500	$ 27,000	$ 40,500	
Wet Well Isolation Gates	EA	2	$ 50,000	$ 100,000	$ 13,500	$ 27,000	$ 127,000	
Misc Metals (Grating, Handrail, Monorails, Etc.	LS	1	$ 150,000	$ 150,000	$ -	$ -	$ 150,000	
Start-up and testing	LS	1	$ 13,500	$ 13,500	$ -	$ -	$ 13,500	

Subtotal	**$**	**17,700,000**
Electrical, Controls and Instrumentation (15%)	**$**	**2,700,000**
Utility Relocation / Coordination (5%)	**$**	**900,000**
MPT (5%)	**$**	**900,000**
General Conditions, Bonds & Insurance (5% of Subtotal)	**$**	**1,100,000**
Base Probable Construction Cost (Rounded)	**$**	**23,300,000**
Contingency (40%)	**$**	**9,320,000**
Total Probable Construction Cost	**$**	**32,620,000**
Total Probable Construction Cost per Gallon	**$**	**9.06**

(1) For items without installation cost, installation cost is included in material price.

(2) Year 2022 dollars. Does not include engineering, administrative, and legal costs or contingency.

CSO017_6 Bass Alley - Life Cycle Cost Estimate (50 years) for Offline Storage Tank with Dewatering Pumps

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Dewatering Pumps					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Electrical Demands					
Dewatering Pumps (assumed 50 HP)	948	kWh	$ 0.14	$ 2,700	Based on activations per year, running 24 hours/activation, ME 85%, ML 90%
					Input kW = HP x Quantity x Motor Load (ML) x 0.746 / Motor Efficiency (ME)
Water for Tipping Buckets	35.43	1000 cft	$ 22.83	$ 809	Assumes anticipated no. activations x 100 gal/ft of tipping bucket x length of tipping buckets
	4	quarter	$ 399.20	$ 1,597	$399.20 quarterly for 2" connection (specs mention 2" solenoid valve so flushing line is assumed to have that diameter)
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	1 millwright (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 37.31	$ 3,880	1 millwright's helper (1.5 x wage to capture fringe benefits) @ 2 hours per week
	104	hr	$ 43.73	$ 4,547	2 instrument techs @ 1 hour per week
Biweekly Yards and Grounds Maintenance	104	hr	$ 33.00	$ 3,432	2 laborers @ 2 hrs biweekly
Quarterly Maintenance	64	hr	$ 43.73	$ 2,798	1 millwright @ 2 days per quarter
	64	hr	$ 37.31	$ 2,388	1 millwright's helper @ 2 days per quarter
	64	hr	$ 33.00	$ 2,112	1 laborer @ 2 days per quarter
Annual Maintenance Labor (clean tank / pigging FM)	160	hr	$ 45.00	$ 7,200	2 Vactor Crews: 2 EOs @ 5 days per year
	240	hr	$ 42.00	$ 10,080	2 ERC Crews: 3 SCW @ 5 days per year
Annual Property Maintenance	1	LS	$ 2,500.00	$ 2,500	Fence repair, landscaping upkeep
ANNUAL LABOR AND UTILITY TOTAL				$ 51,790	
Millwright's Truck	168	hour	$ 20.00	$ 3,360	1 Millwright's Truck ($150,000, 5 year life) @ 168 hours per year (weekly check plus quarterly maintenance) rounded to $20/hr
ERC Truck	1	week	$ 1,153.85	$ 1,154	2 ERC Truck ($150,000, 5 year life) @ 1 week per year (annual maintenance)
Vactor Truck	1	week	$ 6,410.26	$ 6,410	2 Vactor Trucks ($500K each, 3 year life) @ 1 work week per year
Skid Steer	1	week	$ 346.15	$ 346	2 Skid Steers ($45K each, 5 year life) @ 1 work week per year
Lubricants / Misc. Supplies	1	LS	$ 1,000.00	$ 1,000	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 12,270	
				Total Cost	
Rehabilitation Expenses					
Minor Pump Rehabilitation Labor (every 2 years)	10	hr	$ 43.73	$ 437	Assumes 5 hours for 2 millwrights
Minor Pump Rehabilitation Parts (every 2 years)	1	LS	$ 1,000.00	$ 1,000	Allowance for seals and other wearing parts.
Major Pump Rehabilitation Labor (every 5 years)	48	hr	$ 43.73	$ 2,099	3 days for 2 millwrights
Major Pump Rehabilitation Parts (every 5 years)	1	LS	$ 7,500.00	$ 7,500	Assumed centrifugal pump. Allowance for bearings, impellers, full pump end work.
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Electrical Replacement Parts (every 5 years)	1	LS	$ 300.00	$ 300	Breakers, relays
Minor Electrical De-Energized Maintenance and IR scans (every 5 years)	16	hr	$ 105.29	$ 1,685	1 day electrical maintenance (assuming breakers can be fully isolated for de-energized maintenance; no generator required). IR Scan 2 people, 1 day @ $105.29/hr.
PS Building Minor Maintenance (every 10 years)	1	LS	$ 5,000.00	$ 5,000	Painting, other property maintenance
PS HVAC Equipment Replacement (every 10 years)	1	LS	$ 100,000.00	$ 100,000	In line with Babcock PS
Cleaning Equipment Replacement (every 20 years)	1	LS	$ 596,250.00	$ 596,250	May also require crane
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Pump Replacement (at year 25)	1	LS	$ 184,000.00	$ 184,000	Includes motor
Misc Metal Replacement (at year 25)	1	LS	$ 50,000.00	$ 50,000	Grating, railing, hatches
MCC Cabinet Replacement (every 30 years)	1	LS	$ 10,000.00	$ 10,000	New buckets
PS Building Rehabilitation (every 30 years)	1	LS	$ 15,000.00	$ 15,000	Roof and window replacement

CSO017_6 Bass Alley - OLS Tank with Pumped Dewatering

Assumed Interest Rate = i = 5.0%
Assumed Inflation Rate = I = 4.5%

	Tank and Pump Maintenance												
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Annual Parts Cost (PM. maint.)[2]	Rehab Cost (2 yr. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (10 yr. maint.)[2]	Rehab Cost (20 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Rehab Cost (30 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0													
1	$ 54,121				$ 12,822							$ 66,943	$ 63,755
2	$ 56,556	$ 477			$ 13,399	$ 1,092						$ 71,525	$ 64,875
3	$ 59,101				$ 14,002							$ 73,103	$ 63,149
4	$ 61,761	$ 521			$ 14,633	$ 1,193						$ 78,107	$ 64,259
5	$ 64,540		$ 4,715		$ 15,291		$ 28,413					$ 112,959	$ 88,506
6	$ 67,444	$ 569			$ 15,979	$ 1,302						$ 85,295	$ 63,648
7	$ 70,479				$ 16,698							$ 87,177	$ 61,955
8	$ 73,651	$ 622			$ 17,450	$ 1,422						$ 93,144	$ 63,044
9	$ 76,965				$ 18,235							$ 95,200	$ 61,367
10	$ 80,428	$ 679	$ 5,876		$ 19,055	$ 1,553	$ 35,408	$ 163,062				$ 306,061	$ 187,895
11	$ 84,048				$ 19,913							$ 103,960	$ 60,783
12	$ 87,830	$ 742			$ 20,809	$ 1,696						$ 111,076	$ 61,851
13	$ 91,782				$ 21,745							$ 113,527	$ 60,206
14	$ 95,912	$ 810			$ 22,724	$ 1,852						$ 121,298	$ 61,264
15	$ 100,228		$ 7,322		$ 23,746		$ 44,124					$ 175,421	$ 84,381
16	$ 104,739	$ 884			$ 24,815	$ 2,022						$ 132,460	$ 60,682
17	$ 109,452				$ 25,932							$ 135,383	$ 59,067
18	$ 114,377	$ 966			$ 27,099	$ 2,208						$ 144,650	$ 60,105
19	$ 119,524				$ 28,318							$ 147,842	$ 58,506
20	$ 124,903	$ 1,055	$ 9,125		$ 29,592	$ 2,412	$ 54,987	$ 253,230	$ 1,437,984			$ 1,913,287	$ 721,098
21	$ 130,523				$ 30,924							$ 161,447	$ 57,950
22	$ 136,397	$ 1,152			$ 32,316	$ 2,634						$ 172,498	$ 58,968
23	$ 142,535				$ 33,770							$ 176,304	$ 57,400
24	$ 148,949	$ 1,258			$ 35,289	$ 2,876						$ 188,372	$ 58,408
25	$ 155,651		$ 11,371	$ 150,272	$ 36,877		$ 68,524			$ 703,272		$ 1,125,967	$ 332,501
26	$ 162,656	$ 1,373			$ 38,537	$ 3,141						$ 205,707	$ 57,853
27	$ 169,975				$ 40,271							$ 210,246	$ 56,314
28	$ 177,624	$ 1,500			$ 42,083	$ 3,430						$ 224,637	$ 57,303
29	$ 185,617				$ 43,977							$ 229,594	$ 55,779
30	$ 193,970	$ 1,638	$ 14,170		$ 45,956	$ 3,745	$ 85,393	$ 393,258			$ 93,633	$ 831,764	$ 192,451
31	$ 202,699				$ 48,024							$ 250,723	$ 55,249
32	$ 211,820	$ 1,788			$ 50,185	$ 4,090						$ 267,884	$ 56,220
33	$ 221,352				$ 52,443							$ 273,795	$ 54,724
34	$ 231,313	$ 1,953			$ 54,803	$ 4,466						$ 292,536	$ 55,686
35	$ 241,722		$ 17,659		$ 57,270		$ 106,416					$ 423,066	$ 76,698
36	$ 252,599	$ 2,133			$ 59,847	$ 4,877						$ 319,456	$ 55,156
37	$ 263,966				$ 62,540							$ 326,506	$ 53,689
38	$ 275,845	$ 2,329			$ 65,354	$ 5,326						$ 348,854	$ 54,632
39	$ 288,258				$ 68,295							$ 356,553	$ 53,179
40	$ 301,230	$ 2,543	$ 22,006		$ 71,368	$ 5,816	$ 132,613	$ 610,718	$ 3,468,007			$ 4,614,302	$ 655,442
41	$ 314,785				$ 74,580							$ 389,365	$ 52,674
42	$ 328,950	$ 2,777			$ 77,936	$ 6,352						$ 416,015	$ 53,599
43	$ 343,753				$ 81,443							$ 425,196	$ 52,173
44	$ 359,222	$ 3,033			$ 85,108	$ 6,936						$ 454,299	$ 53,090
45	$ 375,387		$ 27,423		$ 88,938		$ 165,260					$ 657,008	$ 73,123
46	$ 392,279	$ 3,312			$ 92,940	$ 7,574						$ 496,106	$ 52,586
47	$ 409,932				$ 97,122							$ 507,054	$ 51,187
48	$ 428,379	$ 3,617			$ 101,493	$ 8,271						$ 541,760	$ 52,086
49	$ 447,656				$ 106,060							$ 553,716	$ 50,700
50	$ 467,800	$ 3,950	$ 34,174	$ 451,632	$ 110,833	$ 9,033	$ 205,944	$ 948,427		$ 2,113,637		$ 4,345,429	$ 378,938
													$ 5,096,160

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

Life Cycle Cost Estimate (50 years) for Real Time Control Structure

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
Real Time Control Structure					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Electrical Demands					
Actuators	4	quarter	$ 100.00	$ 400	Plant personnel states electrical usage at each RTC site is approx. $100/quarter
Routine Maintenance Expenses					
Weekly Check	104	hr	$ 43.73	$ 4,547	2 instrument techs @ 1 hour per week
Quarterly Maintenance	64	hr	$ 43.73	$ 2,798	1 millwright @ 2 days per quarter
	64	hr	$ 37.31	$ 2,388	1 millwright's helper @ 2 days per quarter
	64	hr	$ 33.00	$ 2,112	1 laborer @ 2 days per quarter
Annual Maintenance Labor (clean RTC of debris)	16	hr	$ 45.00	$ 720	1 Vactor Crews: 2 EOs @ 1 day per year
ANNUAL LABOR AND ELECTRICAL TOTAL				$ 15,565	
Millwright's Truck	64	hour	$ 20.00	$ 1,280	1 Millwright's Truck ($150,000, 5 year life) @ 64 hours per year (quarterly maintenance) rounded to $20/hr
Vactor Truck	1	day	$ 456.62	$ 457	1 Vactor Truck ($500K each, 3 year life) @ 1 day per year
Lubricants / Misc. Supplies	1	LS	$ 1,000.00	$ 1,000	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ 2,737	
				Total Cost	
Rehabilitation Expenses					
Minor Gate / Actuator Service Labor (every 2 years)	10	hr	$ 43.73	$ 437	Assumes 5 hours for 2 millwrights
Minor Gate / Actuator Service Parts (every 2 years)	1	LS	$ 500.00	$ 500	Allowance for wearing parts.
Major Gate / Actuator Service Labor (every 5 years)	64	hr	$ 43.73	$ 2,798	2 days for 2 millwrights and 2 Instrument Techs
Major Gate / Actuator Service Parts (every 5 years)	1	LS	$ 5,000.00	$ 5,000	
Major Gate / Actuator Service Outside 3rd party Service Order (every 5 years)	1	LS	$ 8,000.00	$ 8,000	Service order bid - Third party vendor service support
Instrumentation Upgrades (every 5 years)	1	LS	$ 3,000.00	$ 3,000	Level, pressure, temp sensors
Electrical/Controls Replacement Parts (every 5 years)	1	LS	$ 1,000.00	$ 1,000	Breakers, relays, cards
Minor Electrical De-Energized Maintenance and IR scans (every 5 years)	16	hr	$ 105.29	$ 1,685	1 day electrical maintenance (assuming breakers can be fully isolated for de-energized maintenance; no generator required). IR Scan 2 people, 1 day @ $105.29/hr.
Control Panel Component Parts Replacement (every 10 years)	1	LS	$ 10,000.00	$ 10,000	I/O cards, relays, switches, etc.
Engineering Evaluation (at year 25)	1	LS	$ 50,000.00	$ 50,000	Structural inspection, global control strategy review, etc.
Actuator Replacement (at year 25)	2	count	$ 30,000.00	$ 60,000	Assumes 2 actuators per RTC
Misc Metal Replacement (at year 25)	1	LS	$ 10,000.00	$ 10,000	Hatches

Real-Time Control (RTC) Structure

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

	RTC Structure Maintenance										
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Annual Parts Cost (PM. maint.)[2]	Rehab Cost (2 yr. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (10 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0											
1	$ 16,266				$ 2,860					$ 19,126	$ 18,215
2	$ 16,998	$ 477			$ 2,988	$ 546				$ 21,010	$ 19,056
3	$ 17,763				$ 3,123					$ 20,886	$ 18,042
4	$ 18,562	$ 521			$ 3,263	$ 596				$ 22,943	$ 18,875
5	$ 19,397		$ 5,587		$ 3,410		$ 21,185			$ 49,579	$ 38,847
6	$ 20,270	$ 569			$ 3,564	$ 651				$ 25,054	$ 18,696
7	$ 21,182				$ 3,724					$ 24,906	$ 17,701
8	$ 22,135	$ 622			$ 3,892	$ 711				$ 27,360	$ 18,518
9	$ 23,132				$ 4,067					$ 27,198	$ 17,532
10	$ 24,172	$ 679	$ 6,962		$ 4,250	$ 776	$ 26,400	$ 15,530		$ 78,770	$ 48,358
11	$ 25,260				$ 4,441					$ 29,701	$ 17,366
12	$ 26,397	$ 742			$ 4,641	$ 848				$ 32,627	$ 18,168
13	$ 27,585				$ 4,850					$ 32,435	$ 17,201
14	$ 28,826	$ 810			$ 5,068	$ 926				$ 35,630	$ 17,996
15	$ 30,123		$ 8,676		$ 5,296		$ 32,900			$ 76,995	$ 37,036
16	$ 31,479	$ 884			$ 5,534	$ 1,011				$ 38,909	$ 17,825
17	$ 32,895				$ 5,784					$ 38,679	$ 16,875
18	$ 34,376	$ 966			$ 6,044	$ 1,104				$ 42,489	$ 17,655
19	$ 35,923				$ 6,316					$ 42,238	$ 16,715
20	$ 37,539	$ 1,055	$ 10,812		$ 6,600	$ 1,206	$ 40,999	$ 24,117		$ 122,328	$ 46,104
21	$ 39,228				$ 6,897					$ 46,125	$ 16,556
22	$ 40,994	$ 1,152			$ 7,207	$ 1,317				$ 50,669	$ 17,321
23	$ 42,838				$ 7,532					$ 50,370	$ 16,399
24	$ 44,766	$ 1,258			$ 7,871	$ 1,438				$ 55,332	$ 17,157
25	$ 46,781		$ 13,473	$ 150,272	$ 8,225		$ 51,092		$ 210,380	$ 480,223	$ 141,811
26	$ 48,886	$ 1,373			$ 8,595	$ 1,570				$ 60,424	$ 16,994
27	$ 51,086				$ 8,982					$ 60,067	$ 16,089
28	$ 53,384	$ 1,500			$ 9,386	$ 1,715				$ 65,985	$ 16,832
29	$ 55,787				$ 9,808					$ 65,595	$ 15,936
30	$ 58,297	$ 1,638	$ 16,790		$ 10,250	$ 1,873	$ 63,670	$ 37,453		$ 189,971	$ 43,955
31	$ 60,920				$ 10,711					$ 71,631	$ 15,785
32	$ 63,662	$ 1,788			$ 11,193	$ 2,045				$ 78,688	$ 16,514
33	$ 66,527				$ 11,696					$ 78,223	$ 15,635
34	$ 69,520	$ 1,953			$ 12,223	$ 2,233				$ 85,929	$ 16,357
35	$ 72,649		$ 20,924		$ 12,773		$ 79,345			$ 185,690	$ 33,664
36	$ 75,918	$ 2,133			$ 13,348	$ 2,439				$ 93,837	$ 16,202
37	$ 79,334				$ 13,948					$ 93,282	$ 15,339
38	$ 82,904	$ 2,329			$ 14,576	$ 2,663				$ 102,472	$ 16,048
39	$ 86,635				$ 15,232					$ 101,867	$ 15,193
40	$ 90,534	$ 2,543	$ 26,075		$ 15,917	$ 2,908	$ 98,878	$ 58,164		$ 295,019	$ 41,906
41	$ 94,608				$ 16,633					$ 111,241	$ 15,049
42	$ 98,865	$ 2,777			$ 17,382	$ 3,176				$ 122,200	$ 15,744
43	$ 103,314				$ 18,164					$ 121,478	$ 14,906
44	$ 107,963	$ 3,033			$ 18,982	$ 3,468				$ 133,445	$ 15,595
45	$ 112,821		$ 32,494		$ 19,836		$ 123,220			$ 288,371	$ 32,095
46	$ 117,898	$ 3,312			$ 20,728	$ 3,787				$ 145,726	$ 15,446
47	$ 123,204				$ 21,661					$ 144,865	$ 14,624
48	$ 128,748	$ 3,617			$ 22,636	$ 4,136				$ 159,136	$ 15,300
49	$ 134,542				$ 23,654					$ 158,196	$ 14,485
50	$ 140,596	$ 3,950	$ 40,494	$ 451,632	$ 24,719	$ 4,516	$ 153,555	$ 90,326	$ 632,285	$ 1,542,072	$ 134,474
											$ 1,266,200

1. Labor Rates are calculated on O&M Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

CSO017_1.1 SPP054 Sewer Separation Opinion of Probable Construction Costs

Item	Description	Quantity	Unit	Cost per Unit	Total
1.0 Storm Sewer					
1.1	24" PVC	593	LF	$ 110	$ 65,184
1.2	30" RCP	418	LF	$ 120	$ 50,111
1.3	Trench and Restoration - Pavement Areas	1,010	LF	$ 162.00	$ 163,648
1.4	2'x2' Catch Basin	20	EA	$ 4,820	$ 96,400
1.5	4' Dia Manhole	8	EA	$ 3,065	$ 24,521
1.6	Cutting pavement subbase	2,020	LF	$ 4	$ 8,117
1.7	Milling full roadway		SY	$ 3.44	$ -
1.8	Utility Relocation allowance	1	LS	$ 50,000	$ 50,000
				SUBTOTAL	*$ 457,980*
				ROUNDED	***$ 460,000***
2.0 Misc. Construction Costs					
2.1	Div 1 / Mobilization[(1)]	5%			$ 23,000
2.2	Legal, Engineering and Administration[(2)]				$ -
				SUBTOTAL	$ 483,000
2.3	Contingency	40%			$ 184,000
2.4	Allowance - Utility Coordination & Permitting	0.5%			$ 2,300
				TOTAL	**$ 669,300**
				ROUNDED	**$ 700,000**

[(1)]Contractor's contract execution costs + cost to mobilize equipment and labor to the job site.

[(2)]Fees for design engineering, construction administration, and Owner's contract execution.

CSO017_1.1 SPP054 Sewer Separation O&M Costs

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
Gravity Sewers					
Operations Expenses					
		$/wk		$ -	
Routine Maintenance Expenses					
Budget for occasional issues/repairs	1	LS	$ 5,000.00	$ 5,000	
TOTAL ANNUAL COSTS				$ 5,000	
Rehabilitation Expenses					
Jet cleaning of gravity sewers - Labor (every 5 years)	80	hr	$ 45.00	$ 3,600	1 Vactor Crews: 2 EOs @ 5 days
Jet cleaning of gravity sewers - Vactor Truck (every 5 years)	1	week	$ 6,410.26	$ 6,410	1 Vactor Truck ($500K each, 3 year life) @ 1 work week
CCTV inspection - Labor (every 5 years)	80	hr	$ 45.00	$ 3,600	1 CCTV Crew: 2 EOs @ 5 days
CCTV inspection - CCTV Truck (every 5 years)	1	week	$ 3,205.13	$ 3,205	1 CCTV Truck ($250K each, 3 year life) @ 1 work week
Manhole maintenance (every 10 years)	1	LS	$ 3,151.31	$ 3,151	Assumes manhole rehab company provides labor and materials
Manhole rehabilitation (every 25 years)	1	LS	$ 33,592.00	$ 33,592	Assumes manhole rehab company provides labor and materials

CSO017_1.1 SPP054 Sewer Separation O&M Costs

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

	Sewer Maintenance								
Year (n)	Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Annual Parts Cost (PM. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (10 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0									
1				$ 5,225				$ 5,225	$ 4,976
2				$ 5,460				$ 5,460	$ 4,952
3				$ 5,706				$ 5,706	$ 4,929
4				$ 5,963				$ 5,963	$ 4,905
5			$ 8,973	$ 6,231	$ 11,983			$ 27,186	$ 21,301
6				$ 6,511				$ 6,511	$ 4,859
7				$ 6,804				$ 6,804	$ 4,836
8				$ 7,111				$ 7,111	$ 4,813
9				$ 7,430				$ 7,430	$ 4,790
10			$ 11,181	$ 7,765	$ 14,932	$ 4,894		$ 38,773	$ 23,803
11				$ 8,114				$ 8,114	$ 4,744
12				$ 8,479				$ 8,479	$ 4,722
13				$ 8,861				$ 8,861	$ 4,699
14				$ 9,260				$ 9,260	$ 4,677
15			$ 13,934	$ 9,676	$ 18,608			$ 42,219	$ 20,308
16				$ 10,112				$ 10,112	$ 4,632
17				$ 10,567				$ 10,567	$ 4,610
18				$ 11,042				$ 11,042	$ 4,588
19				$ 11,539				$ 11,539	$ 4,566
20			$ 17,364	$ 12,059	$ 23,190	$ 7,600		$ 60,213	$ 22,693
21				$ 12,601				$ 12,601	$ 4,523
22				$ 13,168				$ 13,168	$ 4,502
23				$ 13,761				$ 13,761	$ 4,480
24				$ 14,380				$ 14,380	$ 4,459
25			$ 21,639	$ 15,027	$ 28,898		$ 100,959	$ 166,523	$ 49,175
26				$ 15,703				$ 15,703	$ 4,416
27				$ 16,410				$ 16,410	$ 4,395
28				$ 17,148				$ 17,148	$ 4,374
29				$ 17,920				$ 17,920	$ 4,354
30			$ 26,966	$ 18,727	$ 36,013	$ 11,803		$ 93,508	$ 21,636
31				$ 19,569				$ 19,569	$ 4,312
32				$ 20,450				$ 20,450	$ 4,292
33				$ 21,370				$ 21,370	$ 4,271
34				$ 22,332				$ 22,332	$ 4,251
35			$ 33,605	$ 23,337	$ 44,878			$ 101,820	$ 18,459
36				$ 24,387				$ 24,387	$ 4,211
37				$ 25,484				$ 25,484	$ 4,191
38				$ 26,631				$ 26,631	$ 4,171
39				$ 27,829				$ 27,829	$ 4,151
40			$ 41,878	$ 29,082	$ 55,927	$ 18,329		$ 145,215	$ 20,627
41				$ 30,391				$ 30,391	$ 4,111
42				$ 31,758				$ 31,758	$ 4,092
43				$ 33,187				$ 33,187	$ 4,072
44				$ 34,681				$ 34,681	$ 4,053
45			$ 52,187	$ 36,241	$ 69,695			$ 158,123	$ 17,599
46				$ 37,872				$ 37,872	$ 4,014
47				$ 39,576				$ 39,576	$ 3,995
48				$ 41,357				$ 41,357	$ 3,976
49				$ 43,218				$ 43,218	$ 3,957
50			$ 65,035	$ 45,163	$ 86,852	$ 28,465	$ 100,959	$ 326,474	$ 28,470
									$ 422,000

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

CSO064_2 Perry St Sewer Separation Opinion of Probable Construction Costs

Item	Description	Quantity	Unit	Cost per Unit	Total
1.0 Storm Sewer					
1.1	18" PVC	1,385	LF	$ 345	$ 477,713
1.2	24" PVC	2,730	LF	$ 110	$ 300,296
1.3	36" RCP	1,040	LF	$ 240	$ 249,648
1.4	42" RCP	1,262	LF	$ 480	$ 605,664
1.5	Trench and Restoration - Pavement Areas	6,417	LF	$ 208.00	$ 1,334,662
1.6	2'x2' Catch Basin	25	EA	$ 4,820	$ 120,500
1.7	4' Dia Manhole	14	EA	$ 3,065	$ 42,912
1.8	Cutting pavement subbase	12,833	LF	$ 4	$ 51,559
1.9	Milling full roadway		SY	$ 3.44	$ -
1.10	Utility Relocation allowance	1	LS	$ 100,000	$ 100,000
				SUBTOTAL	*$ 3,282,954*
				ROUNDED	***$ 3,290,000***
2.0 Misc. Construction Costs					
2.1	Div 1 / Mobilization[(1)]	5%			$ 164,500
2.2	Legal, Engineering and Administration[(2)]				$ -
2.3	Contingency	40%			$ 1,316,000
2.4	Allowance - Utility Coordination & Permitting	0.5%			$ 16,450
				TOTAL	**$ 4,786,950**
				ROUNDED	**$ 4,800,000**

[(1)]Contractor's contract execution costs + cost to mobilize equipment and labor to the job site.

[(2)]Fees for design engineering, construction administration, and Owner's contract execution.

CSO064_2 Perry St Sewer Separation O&M Costs

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
Gravity Sewers and Force Mains					
Operations Expenses					
		$/wk		$ -	
Routine Maintenance Expenses					
Budget for occasional issues/repairs	1	LS	$ 5,000.00	$ 5,000	
TOTAL ANNUAL COSTS				$ 5,000	
Rehabilitation Expenses					
Jet cleaning of gravity sewers - Labor (every 5 years)	80	hr	$ 45.00	$ 3,600	1 Vactor Crews: 2 EOs @ 5 days
Jet cleaning of gravity sewers - Vactor Truck (every 5 years)	1	week	$ 6,410.26	$ 6,410	1 Vactor Truck ($500K each, 3 year life) @ 1 work week
CCTV inspection - Labor (every 5 years)	80	hr	$ 45.00	$ 3,600	1 CCTV Crew: 2 EOs @ 5 days
CCTV inspection - CCTV Truck (every 5 years)	1	week	$ 3,205.13	$ 3,205	1 CCTV Truck ($250K each, 3 year life) @ 1 work week
Manhole maintenance (every 10 years)	1	LS	$ 5,514.80	$ 5,515	Assumes manhole rehab company provides labor and materials
Manhole rehabilitation (every 25 years)	1	LS	$ 58,786.00	$ 58,786	Assumes manhole rehab company provides labor and materials

CSO064_2 Perry St Sewer Separation O&M Costs

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

Year (n)	Sewer Maintenance: Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Annual Parts Cost (PM. maint.)[2]	Rehab Cost (5 yr. maint.)[2]	Rehab Cost (10 yr. maint.)[2]	Rehab Cost (25 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0									
1				$ 5,225				$ 5,225	$ 4,976
2				$ 5,460				$ 5,460	$ 4,952
3				$ 5,706				$ 5,706	$ 4,929
4				$ 5,963				$ 5,963	$ 4,905
5			$ 8,973	$ 6,231	$ 11,983			$ 27,186	$ 21,301
6				$ 6,511				$ 6,511	$ 4,859
7				$ 6,804				$ 6,804	$ 4,836
8				$ 7,111				$ 7,111	$ 4,813
9				$ 7,430				$ 7,430	$ 4,790
10			$ 11,181	$ 7,765	$ 14,932	$ 8,564		$ 42,443	$ 26,056
11				$ 8,114				$ 8,114	$ 4,744
12				$ 8,479				$ 8,479	$ 4,722
13				$ 8,861				$ 8,861	$ 4,699
14				$ 9,260				$ 9,260	$ 4,677
15			$ 13,934	$ 9,676	$ 18,608			$ 42,219	$ 20,308
16				$ 10,112				$ 10,112	$ 4,632
17				$ 10,567				$ 10,567	$ 4,610
18				$ 11,042				$ 11,042	$ 4,588
19				$ 11,539				$ 11,539	$ 4,566
20			$ 17,364	$ 12,059	$ 23,190	$ 13,300		$ 65,913	$ 24,842
21				$ 12,601				$ 12,601	$ 4,523
22				$ 13,168				$ 13,168	$ 4,502
23				$ 13,761				$ 13,761	$ 4,480
24				$ 14,380				$ 14,380	$ 4,459
25			$ 21,639	$ 15,027	$ 28,898		$ 176,677	$ 242,242	$ 71,535
26				$ 15,703				$ 15,703	$ 4,416
27				$ 16,410				$ 16,410	$ 4,395
28				$ 17,148				$ 17,148	$ 4,374
29				$ 17,920				$ 17,920	$ 4,354
30			$ 26,966	$ 18,727	$ 36,013	$ 20,655		$ 102,360	$ 23,684
31				$ 19,569				$ 19,569	$ 4,312
32				$ 20,450				$ 20,450	$ 4,292
33				$ 21,370				$ 21,370	$ 4,271
34				$ 22,332				$ 22,332	$ 4,251
35			$ 33,605	$ 23,337	$ 44,878			$ 101,820	$ 18,459
36				$ 24,387				$ 24,387	$ 4,211
37				$ 25,484				$ 25,484	$ 4,191
38				$ 26,631				$ 26,631	$ 4,171
39				$ 27,829				$ 27,829	$ 4,151
40			$ 41,878	$ 29,082	$ 55,927	$ 32,076		$ 158,962	$ 22,580
41				$ 30,391				$ 30,391	$ 4,111
42				$ 31,758				$ 31,758	$ 4,092
43				$ 33,187				$ 33,187	$ 4,072
44				$ 34,681				$ 34,681	$ 4,053
45			$ 52,187	$ 36,241	$ 69,695			$ 158,123	$ 17,599
46				$ 37,872				$ 37,872	$ 4,014
47				$ 39,576				$ 39,576	$ 3,995
48				$ 41,357				$ 41,357	$ 3,976
49				$ 43,218				$ 43,218	$ 3,957
50			$ 65,035	$ 45,163	$ 86,852	$ 49,813	$ 530,993	$ 777,856	$ 67,832
									$ 492,120

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

Life Cycle Cost Estimate (50 years) for SPP Modifications

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
SPP Modifications					
Operations Expenses					
		hour	$ 50.00	$ -	
Routine Maintenance Expenses					
Weekly Check	52	hr	$ 50.00	$ 2,600	2 operators/Sewer Construction Inspectors @ 1 extra hour every other week
Rehabilitation Expenses					
TOTAL ANNUAL COSTS				***$ 2,600***	

SPP Modifications

Assumed Interest Rate = i = 5.0%

Assumed Inflation Rate = I = 4.5%

Year (n)	SPP Maintenance: Annual Labor and Utility Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (10 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Annual Parts Cost (PM. maint.)[2]	Rehab Cost (2 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0									
1	$ 2,717							$ 2,717	$ 2,588
2	$ 2,839							$ 2,839	$ 2,575
3	$ 2,967							$ 2,967	$ 2,563
4	$ 3,101							$ 3,101	$ 2,551
5	$ 3,240							$ 3,240	$ 2,539
6	$ 3,386							$ 3,386	$ 2,527
7	$ 3,538							$ 3,538	$ 2,515
8	$ 3,697							$ 3,697	$ 2,503
9	$ 3,864							$ 3,864	$ 2,491
10	$ 4,038							$ 4,038	$ 2,479
11	$ 4,219							$ 4,219	$ 2,467
12	$ 4,409							$ 4,409	$ 2,455
13	$ 4,608							$ 4,608	$ 2,444
14	$ 4,815							$ 4,815	$ 2,432
15	$ 5,032							$ 5,032	$ 2,420
16	$ 5,258							$ 5,258	$ 2,409
17	$ 5,495							$ 5,495	$ 2,397
18	$ 5,742							$ 5,742	$ 2,386
19	$ 6,000							$ 6,000	$ 2,375
20	$ 6,270							$ 6,270	$ 2,363
21	$ 6,553							$ 6,553	$ 2,352
22	$ 6,847							$ 6,847	$ 2,341
23	$ 7,156							$ 7,156	$ 2,330
24	$ 7,478							$ 7,478	$ 2,319
25	$ 7,814							$ 7,814	$ 2,308
26	$ 8,166							$ 8,166	$ 2,297
27	$ 8,533							$ 8,533	$ 2,286
28	$ 8,917							$ 8,917	$ 2,275
29	$ 9,318							$ 9,318	$ 2,264
30	$ 9,738							$ 9,738	$ 2,253
31	$ 10,176							$ 10,176	$ 2,242
32	$ 10,634							$ 10,634	$ 2,232
33	$ 11,112							$ 11,112	$ 2,221
34	$ 11,613							$ 11,613	$ 2,211
35	$ 12,135							$ 12,135	$ 2,200
36	$ 12,681							$ 12,681	$ 2,190
37	$ 13,252							$ 13,252	$ 2,179
38	$ 13,848							$ 13,848	$ 2,169
39	$ 14,471							$ 14,471	$ 2,158
40	$ 15,123							$ 15,123	$ 2,148
41	$ 15,803							$ 15,803	$ 2,138
42	$ 16,514							$ 16,514	$ 2,128
43	$ 17,257							$ 17,257	$ 2,118
44	$ 18,034							$ 18,034	$ 2,107
45	$ 18,845							$ 18,845	$ 2,097
46	$ 19,693							$ 19,693	$ 2,087
47	$ 20,580							$ 20,580	$ 2,078
48	$ 21,506							$ 21,506	$ 2,068
49	$ 22,474							$ 22,474	$ 2,058
50	$ 23,485							$ 23,485	$ 2,048
									$ 115,380

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

Life Cycle Cost Estimate (50 years) for Northern Relief Tunnel

Description	Quantity	Unit	Unit Cost	Total Annual Cost	Comments
Annual Operation & Maintenance					
OLS Tank with Gravity Dewatering					
Operations Expenses					
Licensed Wastewater Treatment Plant Operator	52	hour	$ 50.00	$ 2,600	SCADA monitoring of entire collection system @ 1 hour per week
Communications	12	month	$ 50.00	$ 600	Cellular data, alarm system, etc.
ANNUAL LABOR AND ELECTRICAL TOTAL				$ 3,200	
ANNUAL PARTS AND EQUIPMENT TOTAL				$ -	
				Total Cost	
Rehabilitation Expenses					
Instrumentation Upgrades (every 5 years)	1	LS	$ 15,000.00	$ 15,000	Level, pressure, temp sensors, I&C/communication equipment
Inspection/Cleaning Service Outside 3rd party Service Order (every 5 years)	1	LS	$ 250,000.00	$ 250,000	Inspection, maintenance, and cleaning of tunnel

Life Cycle Cost Estimate (50 years) for Northern Relief Tunnel

Assumed Interest Rate = i = 5.0%
Assumed Inflation Rate = I = 4.5%

Year (n)	Tunnel Operation and Maintenance: Annual Labor and Electrical Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (10 yr. maint.)[1,2]	Labor Cost (25 yr. maint.)[1,2]	Rehab Cost (5 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0								
1	$ 3,344						$ 3,344	$ 3,185
2	$ 3,494						$ 3,494	$ 3,170
3	$ 3,652						$ 3,652	$ 3,155
4	$ 3,816						$ 3,816	$ 3,139
5	$ 3,988					$ 330,238	$ 334,226	$ 261,875
6	$ 4,167						$ 4,167	$ 3,110
7	$ 4,355						$ 4,355	$ 3,095
8	$ 4,551						$ 4,551	$ 3,080
9	$ 4,756						$ 4,756	$ 3,065
10	$ 4,970					$ 411,537	$ 416,506	$ 255,699
11	$ 5,193						$ 5,193	$ 3,036
12	$ 5,427						$ 5,427	$ 3,022
13	$ 5,671						$ 5,671	$ 3,007
14	$ 5,926						$ 5,926	$ 2,993
15	$ 6,193					$ 512,850	$ 519,043	$ 249,668
16	$ 6,472						$ 6,472	$ 2,965
17	$ 6,763						$ 6,763	$ 2,951
18	$ 7,067						$ 7,067	$ 2,937
19	$ 7,385						$ 7,385	$ 2,923
20	$ 7,717					$ 639,104	$ 646,822	$ 243,780
21	$ 8,065						$ 8,065	$ 2,895
22	$ 8,428						$ 8,428	$ 2,881
23	$ 8,807						$ 8,807	$ 2,867
24	$ 9,203						$ 9,203	$ 2,854
25	$ 9,617					$ 796,440	$ 806,058	$ 238,031
26	$ 10,050						$ 10,050	$ 2,827
27	$ 10,502						$ 10,502	$ 2,813
28	$ 10,975						$ 10,975	$ 2,800
29	$ 11,469						$ 11,469	$ 2,786
30	$ 11,985					$ 992,509	$ 1,004,494	$ 232,417
31	$ 12,524						$ 12,524	$ 2,760
32	$ 13,088						$ 13,088	$ 2,747
33	$ 13,677						$ 13,677	$ 2,734
34	$ 14,292						$ 14,292	$ 2,721
35	$ 14,936					$ 1,236,847	$ 1,251,783	$ 226,936
36	$ 15,608						$ 15,608	$ 2,695
37	$ 16,310						$ 16,310	$ 2,682
38	$ 17,044						$ 17,044	$ 2,669
39	$ 17,811						$ 17,811	$ 2,656
40	$ 18,612					$ 1,541,337	$ 1,559,949	$ 221,584
41	$ 19,450						$ 19,450	$ 2,631
42	$ 20,325						$ 20,325	$ 2,619
43	$ 21,240						$ 21,240	$ 2,606
44	$ 22,196						$ 22,196	$ 2,594
45	$ 23,194					$ 1,920,786	$ 1,943,980	$ 216,358
46	$ 24,238						$ 24,238	$ 2,569
47	$ 25,329						$ 25,329	$ 2,557
48	$ 26,469						$ 26,469	$ 2,545
49	$ 27,660						$ 27,660	$ 2,533
50	$ 28,904					$ 2,393,649	$ 2,422,553	$ 211,256
								$ 2,471,480

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

Opinion of Probable Construction Cost for Permeable Pavement (GI)

Project	Description		Unit	Unit	Cost per Unit	Total
CSO053_12.1	Jefferson Ave GI	Permeable pavement managing 2.3 acres of impervious area	AC	AC	$ 200,000	$ 460,000
CSO053_12.2	Jefferson Ave GI	Permeable Pavement on Jefferson Ave. managing 7.55 acres of impervious area	AC	AC	$ 200,000	$ 1,520,000
CSO055_3	20% GI Implementation	260 acres of impervious area managed	AC	AC	$ 200,000	$ 52,032,000
CSO011_1.1	20% GI Implementation	19.9 acres of impervious area managed	AC	AC	$ 200,000	$ 3,982,000
CSO017_4	20% GI Implementation	37.5 acres of impervious area managed	AC	AC	$ 200,000	$ 7,490,000
CSO006_5	CSO006 20% GI Implementation	52.5 acres of impervious area managed	AC	AC	$ 200,000	$ 10,506,000
CSO053_9	20% GI Implementation	Permeable Pavement (530 acres of impervious area managed)	AC	AC	$ 200,000	$ 3,344,000
CSO026_4	20% GI Implementation	125.5 acres of impervious area managed	AC	AC	$ 200,000	$ 25,104,000
		Totals				**104,438,000.00**

Life Cycle Cost Estimate (50 years) for Permeable Pavement (GI)

Description	Quantity	Unit		Total Annual Cost	Comments
Annual Operation & Maintenance					
Permeable Pavement (GI)					
Operations Expenses					
Fuel	26	$/wk	$	13,000	Assumes $500/every other week fuel needed for both sweepers
Hauling/Disposal of Collected Debris	3	$/ton/day	$	268	Assumes one ton collected each day sweepers operate per production rate below
Routine Maintenance Expenses					
Pavement Vacuum Equipment Operator(s)	21.4	$/hr	$	963	Assume all 178 acres of permeable pavement cleaned twice per year. 1 operator per sweeper. Elgin Whirlwind can clean 12-foot width at a time and is assumed to travel at 3 mph (can go up to 5), enabling rate of 4.36 ac/hr.
Pavement Vacuum Equipment	1	$/yr	$	70,000	Assume $350,000 per unit / 5 years; 1 unit in total
TOTAL ANNUAL COSTS			$	84,231	
Rehabilitation Expenses					
Pavement Repair / Resurfacing (every 10 years)	1	LS	$	5,000,000	Approx. 5% of initial capital cost

Green Infrastruction (Permeable Pavement)

Assumed Interest Rate = i = 5.0%

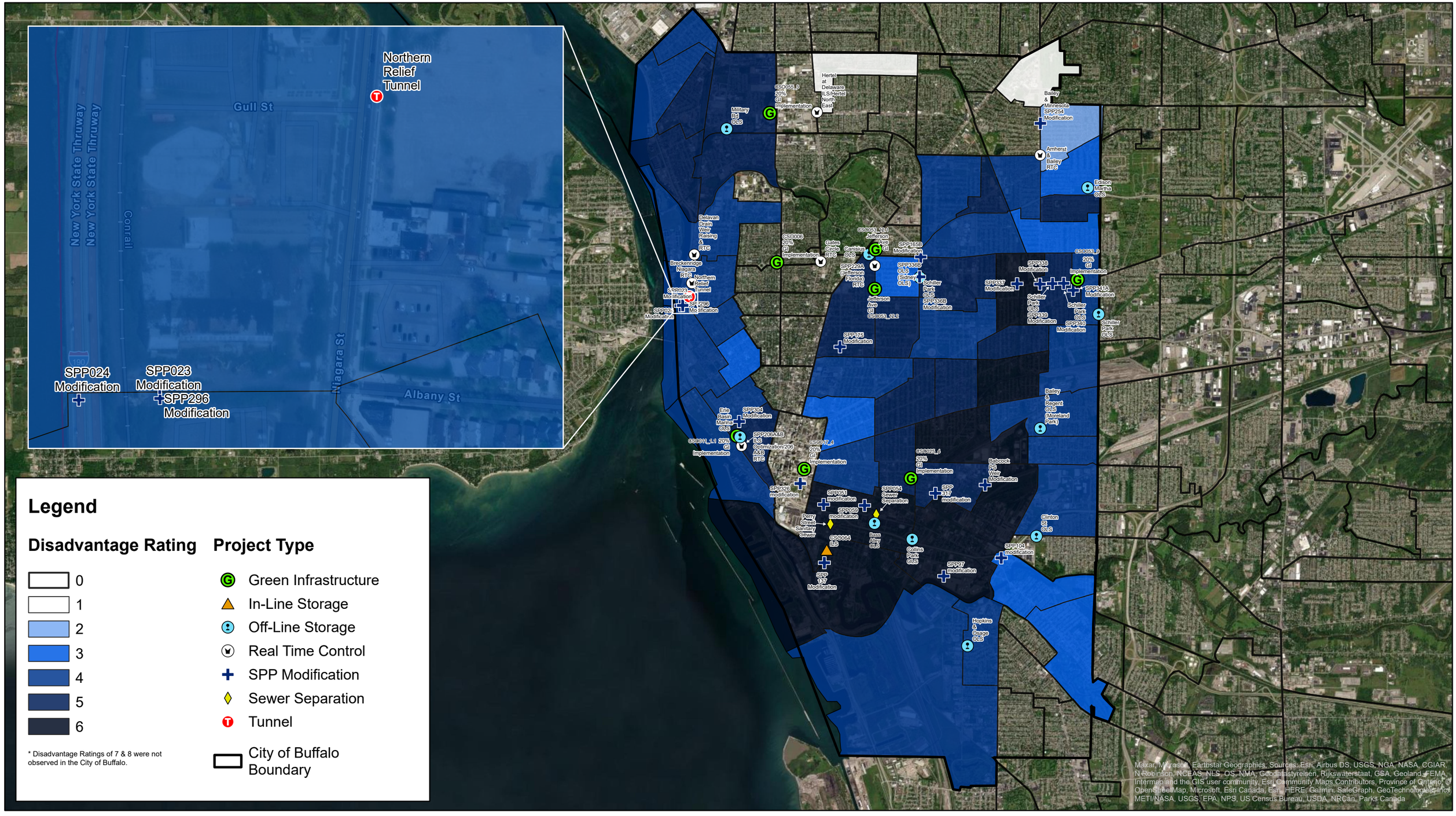
Assumed Inflation Rate = I = 4.5%

	Permeable Pavement Operation and Maintenance								
Year (n)	Annual Labor and Equipment Cost (Prev. maint.)[1,2]	Labor Cost (2 yr. maint.)[1,2]	Labor Cost (5 yr. maint.)[1,2]	Labor Cost (10 yr. maint.)[1,2]	Annual Parts Cost (Prev. maint.)[2]	Rehab Cost (2 yr. maint.)[2]	Rehab Cost (10 yr. maint.)[2]	Total Annual Cost	PW Cost[3]
0									
1	$ 88,021							$ 88,021	$ 83,830
2	$ 91,982							$ 91,982	$ 83,431
3	$ 96,122							$ 96,122	$ 83,033
4	$ 100,447							$ 100,447	$ 82,638
5	$ 104,967							$ 104,967	$ 82,245
6	$ 109,691							$ 109,691	$ 81,853
7	$ 114,627							$ 114,627	$ 81,463
8	$ 119,785							$ 119,785	$ 81,075
9	$ 125,175							$ 125,175	$ 80,689
10	$ 130,808						$ 7,764,847	$ 7,895,655	$ 4,847,247
11	$ 136,695							$ 136,695	$ 79,922
12	$ 142,846							$ 142,846	$ 79,542
13	$ 149,274							$ 149,274	$ 79,163
14	$ 155,991							$ 155,991	$ 78,786
15	$ 163,011							$ 163,011	$ 78,411
16	$ 170,346							$ 170,346	$ 78,038
17	$ 178,012							$ 178,012	$ 77,666
18	$ 186,022							$ 186,022	$ 77,296
19	$ 194,393							$ 194,393	$ 76,928
20	$ 203,141						$ 12,058,570	$ 12,261,711	$ 4,621,310
21	$ 212,282							$ 212,282	$ 76,197
22	$ 221,835							$ 221,835	$ 75,834
23	$ 231,818							$ 231,818	$ 75,473
24	$ 242,250							$ 242,250	$ 75,114
25	$ 253,151							$ 253,151	$ 74,756
26	$ 264,543							$ 264,543	$ 74,400
27	$ 276,447							$ 276,447	$ 74,046
28	$ 288,887							$ 288,887	$ 73,693
29	$ 301,887							$ 301,887	$ 73,342
30	$ 315,472						$ 18,726,591	$ 19,042,063	$ 4,405,904
31	$ 329,668							$ 329,668	$ 72,646
32	$ 344,503							$ 344,503	$ 72,300
33	$ 360,006							$ 360,006	$ 71,955
34	$ 376,206							$ 376,206	$ 71,613
35	$ 393,135							$ 393,135	$ 71,272
36	$ 410,827							$ 410,827	$ 70,932
37	$ 429,314							$ 429,314	$ 70,594
38	$ 448,633							$ 448,633	$ 70,258
39	$ 468,821							$ 468,821	$ 69,924
40	$ 489,918						$ 29,081,823	$ 29,571,741	$ 4,200,538
41	$ 511,965							$ 511,965	$ 69,259
42	$ 535,003							$ 535,003	$ 68,930
43	$ 559,078							$ 559,078	$ 68,601
44	$ 584,237							$ 584,237	$ 68,275
45	$ 610,527							$ 610,527	$ 67,950
46	$ 638,001							$ 638,001	$ 67,626
47	$ 666,711							$ 666,711	$ 67,304
48	$ 696,713							$ 696,713	$ 66,983
49	$ 728,065							$ 728,065	$ 66,664
50	$ 760,828						$ 45,163,181	$ 45,924,009	$ 4,004,745
									$ 25,451,700

1. Labor Rates are calculated on Life Cycle Costs worksheet.
2. Future Annual Cost = Present Annual Cost x (1 + Inflation Rate)^{Year} = $A_o(1+I)^n$ (present annual costs located on the O&M Costs worksheet).
3. Present Worth Cost = PW = Future Annual Cost / (1 + Interest Rate)^{Year} = $F / (1 + i)^n$

Attachment G

DISADVANTAGE RANKING FOR SELECTED ALTERNATIVE PROJECTS



Legend

Disadvantage Rating

- 0
- 1
- 2
- 3
- 4
- 5
- 6

* Disadvantage Ratings of 7 & 8 were not observed in the City of Buffalo.

Project Type

- Green Infrastructure
- In-Line Storage
- Off-Line Storage
- Real Time Control
- SPP Modification
- Sewer Separation
- Tunnel
- City of Buffalo Boundary

0 0.5 1 2 3 Miles

N

Spatial Reference
Name: NAD83 New York West ftUS
PCS: NAD83 New York West ftUS
GCS: GCS North American 1983
Datum: North American 1983
Projection: Transverse Mercator

xylem Let's Solve Water

ARCADIS

GHD

LTCP OPTIMIZATION SELECTED ALTERNATIVE PROJECTS & DISADVANTAGED COMMUNITIES

BUFFALO, NY

Project No. 30085108

Date: 01/12/2023

Data Source:
Disadvantage Ratings Layer - Climate and Economic Justice Screening tool(CEJST)
https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5
rder#overview

LTCP OPTIMIZATION SELECTED ALTERNATIVE PROJECTS & DISADVANTAGED COMMUNITIES

Notes:

(1) The disadvantage ranking of GI projects was calculated using the weighted average of the GI project subcatchments distribution across the various disadvantaged communities.

(2) The disadvantage ranking for all other projects (OLS, RTC, ILS, and SPP Modifications) corresponds to the highest census' tract disadvantage ranking in the 0.25 mi buffer zone around the project.

(3) Data Source: Disadvantage Ratings Layer - Climate and Economic Justice Screening tool (CEJST) https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5'rder#overview

No.	Tag	Project	Disadvantage Rating .25-mi buffer$_3$
1	CSO006_2	Gates Circle RTC	0
2	CSO055_1.1	Hertel at Delaware ILS/Hertel North East	1
3	CSO053_12.1	CSO053_12.1 Jefferson Ave GI$_{(1)}$	1
4	CSO053_3.3	Bailey & Minnesota SPP254 Modification	2
5	CSO055_3	CSO055_3 20% GI Implementation$_{(1)}$	2
6	CSO006_5	CSO006_5 20% GI Implementation$_{(1)}$	3
7	CSO017_4	CSO017_4 20% GI Implementation$_{(1)}$	3
8	CSO033_2	Clinton St OLS	4
9	CSO053_3.2	Amherst & Bailey RTC	4
10	CSO006_3	Delavan Drain Weir Raising & RTC	4
11	CSO011_1.2	SPP024 Modification	4
12	CSO012_1.2	SPP023 Modification	4
13	CSO012_2.1	SPP296 Modification	4
14	CSO028_1	Hopkins & Osage OLS	4
15	System_1	Northern Relief Tunnel	4
16	CSO010_1	Breckenridge Niagara RTC	4
17	CSO011_1.1	CSO011_1.1 20% GI Implementation$_{(1)}$	4
18	CSO053_11	Canisius OLS	5
19	CSO053_5.2	Edison Martha OLS	5
20	System_2	Schiller Park OLS	5
21	CSO053_9	CSO053_9 20% GI Implementation$_{(1)}$	5
22	CSO053_12.2	CSO053_12.2 Jefferson Ave GI$_{(1)}$	5
23	CSO013_1	SPP304 Modification	5

No.	Tag	Project	Disadvantage Rating .25-mi buffer$_3$
24	CSO014_1.1	SPP206A&B ILS Optimization/206 A&B RTC	5
25	CSO014_1.2	Erie Basin Marina OLS	5
26	CSO053_1.4	SPP336B OLS (Sidney OLS)	5
27	CSO053_1.5	Schiller Park OLS SPP336B Modification	5
28	CSO053_10	SPP229A (Jefferson Florida) RTC	5
29	CSO053_13	SPP165B Modification	5
30	CSO053_14	SPP175 Modification	5
31	CSO053_8	SPP341A Modification	5
32	CSO055_1.6	Military Rd OLS	5
33	System_2_4	Schiller Park OLS SPP340 Modification	5
34	CSO053_1.4	SPP326 modification	6
35	CSO033_3	SPP104 modification	6
36	CSO033_1	Bailey & Regent OLS (Moreland Park)	6
37	CSO027_1	SPP 317 modification	6
38	CSO027_2	Babcock PS Weir Modification	6
39	CSO053_3.1	SPP338 Modification	6
40	System_2_3	Schiller Park OLS SPP339 Modification	6
41	CSO026_4	CSO026_4 20% GI Implementation$_{(1)}$	6
42	CSO017_1.1	SPP054 Sewer Separation	6
43	CSO017_10	SPP051 modification	6
44	CSO017_6	Bass Alley OLS	6
45	CSO017_9	SPP059 modification	6
46	CSO026_1.3	Collins Park OLS	6
47	CSO027_3	SPP97 modification	6
48	CSO053_2.5	SPP337 Modification	6
49	CSO064_1.1	CSO064 ILS	6
50	CSO064_1.2	SPP 137 Modification	6
51	CSO064_2	Perry Street Sanitary Sewer	6

Attachment H

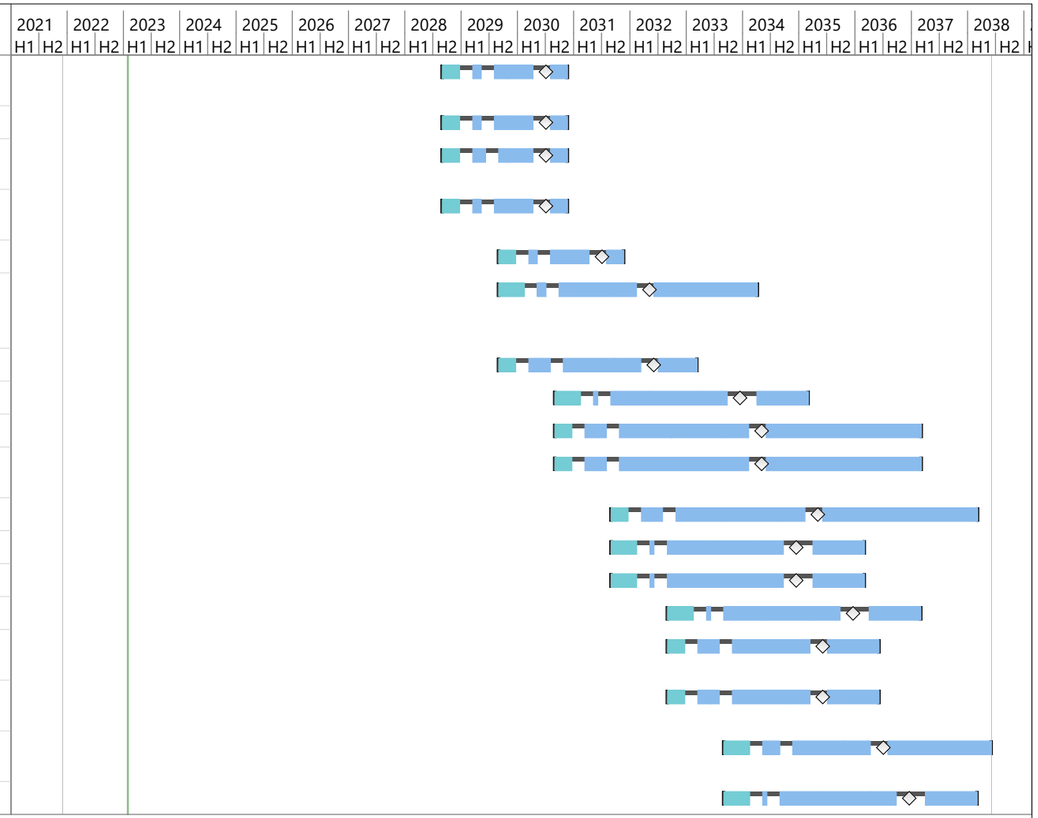
PRELIMINARY IMPLEMENTATION SCHEDULE

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1		**CSO053_11 Canisius OLS**	**1920 days**	**Wed 12/1/21**	**Tue 4/10/29**		
10		**CSO053_3.2 Amherst & Bailey RTC**	**1200 days**	**Wed 12/1/21**	**Tue 7/7/26**		
17		**CSO006_2 Gates Circle RTC**	**1100 days**	**Tue 3/1/22**	**Mon 5/18/26**		
24		**Breckenridge Niagara RTC**	**1285 days**	**Tue 3/1/22**	**Mon 2/1/27**		
31		**CSO053_3.3 SPP254 modification**	**624 days**	**Tue 3/1/22**	**Fri 7/19/24**		
38		**CSO053_12.1 Jefferson Ave Main Beverly GI**	**1120 days**	**Tue 3/1/22**	**Mon 6/15/26**		
46		**CSO053_10 SPP229A Orifice Modification (Jefferson Florida)**	**624 days**	**Tue 3/1/22**	**Fri 7/19/24**		
53		**CSO053_12.2 Jefferson Ave Best Beverly**	**1120 days**	**Tue 3/1/22**	**Mon 6/15/26**		
61		**CSO053_5.2 Edison Martha OLS**	**2000 days**	**Fri 9/1/23**	**Thu 5/1/31**		
79		**CSO053_1.4 SPP336B OLS (Sidney OLS)**	**1760 days**	**Fri 9/1/23**	**Thu 5/30/30**		
88		**CSO053_1.5 Schiller Park OLS SPP336B Modification**	**580 days**	**Fri 9/1/23**	**Thu 11/20/25**		
102		**CSO053_2.5 SPP337 Modification**	**580 days**	**Fri 9/1/23**	**Thu 11/20/25**		
146		**CSO053_13 SPP165B Modification**	**580 days**	**Fri 9/1/23**	**Thu 11/20/25**		
153		**CSO053_8 SPP341A Modification**	**580 days**	**Fri 9/1/23**	**Thu 11/20/25**		
198		**CSO053_3.1 South Bailey DUC/ILS**	**1240 days**	**Fri 9/1/23**	**Thu 6/1/28**		
206		**CSO053_14 SPP175 Modification**	**580 days**	**Fri 9/1/23**	**Thu 11/20/25**		
70		**System_2 Schiller Park OLS**	**1759 days**	**Sun 9/1/24**	**Thu 5/29/31**		
95		**System_2_3 Schiller Park OLS SPP339 Modification**	**579 days**	**Sun 9/1/24**	**Thu 11/19/26**		
109		**CSO014_1.1 SPP206A&B ILS Optimization/206 A&B RTC**	**899 days**	**Sun 9/1/24**	**Thu 2/10/28**		
139		**System_2_4 Schiller Park OLS SPP340 Modification**	**679 days**	**Sun 9/1/24**	**Thu 4/8/27**		
116		**CSO014_1.2 Erie Basin Marina OLS**	**1700 days**	**Mon 9/1/25**	**Fri 3/5/32**		
125		**CSO012_1.2 SPP023 Modification**	**580 days**	**Mon 9/1/25**	**Fri 11/19/27**		
132		**CSO013_1 SPP304 Modification**	**580 days**	**Mon 9/1/25**	**Fri 11/19/27**		
191		**CSO012_2.1 SPP296 Modification**	**580 days**	**Mon 9/1/25**	**Fri 11/19/27**		
234		**CSO017_8 SPP326 modification**	**580 days**	**Mon 9/1/25**	**Fri 11/19/27**		
241		**CSO011_1.2 SPP024 Modification**	**580 days**	**Mon 9/1/25**	**Fri 11/19/27**		
168		**CSO027_2 Babcock PS WEIR#42 modification**	**680 days**	**Tue 9/1/26**	**Mon 4/9/29**		
175		**CSO026_1.3 Collins Park OLS**	**1760 days**	**Tue 9/1/26**	**Mon 5/30/33**		
184		**CSO027_1 Weir #35, SPP 317 modification**	**580 days**	**Tue 9/1/26**	**Mon 11/20/28**		
248		**System_1 Northern Relief Tunnel**	**2940 days**	**Thu 2/25/27**	**Wed 6/2/38**		
257		**CSO055_1.5 Military Rd OLS**	**2050 days**	**Thu 2/25/27**	**Wed 1/3/35**		
160		**CSO053_9 20% GI Implementation**	**1174 days**	**Wed 9/1/27**	**Mon 3/1/32**		
213		**CSO033_2 Clinton St OLS RTC**	**1440 days**	**Fri 9/1/28**	**Thu 3/9/34**		

Project: BSA_LTCP_Rankingand
Date: Mon 1/30/23

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
220		**CSO027_3 SPP97 modification(WEIR#10)**	**580 days**	**Fri 9/1/28**	**Thu 11/21/30**		
290		**CSO017_10 SPP051 modification**	**580 days**	**Fri 9/1/28**	**Thu 11/21/30**		
297		**CSO017_9 SPP059 modification (SPP059_w)**	**580 days**	**Fri 9/1/28**	**Thu 11/21/30**		
338		**CSO033_3 SPP104 modification (WEIR#53)**	**580 days**	**Fri 9/1/28**	**Thu 11/21/30**		
227		**CSO064_1.2 SPP137 Modification**	**579 days**	**Sat 9/1/29**	**Thu 11/20/31**		
266		**CSO006_3 Delavan Drain Storage/Delavan Drain Weir Raising & RTC**	**1199 days**	**Sat 9/1/29**	**Thu 4/6/34**		
313		**CSO064_1.1 OLS Conveyance**	**919 days**	**Sat 9/1/29**	**Thu 3/10/33**		
273		**CSO006_5 20% GI Implementation**	**1175 days**	**Sun 9/1/30**	**Fri 3/2/35**		
281		**CSO028_1 Hopkins & Osage OLS**	**1699 days**	**Sun 9/1/30**	**Thu 3/5/37**		
304		**CSO017_6 Bass Alley & Emslie St. OLS**	**1699 days**	**Sun 9/1/30**	**Thu 3/5/37**		
321		**CSO033_1 Bailey & Regent OLS**	**1700 days**	**Mon 9/1/31**	**Fri 3/5/38**		
330		**CSO011_1.1 20% GI Implementation**	**1175 days**	**Mon 9/1/31**	**Fri 2/29/36**		
345		**CSO017_4 20% GI Implementation**	**1175 days**	**Mon 9/1/31**	**Fri 2/29/36**		
353		**CSO026_4 20% GI Implementation**	**1174 days**	**Wed 9/1/32**	**Mon 3/2/37**		
361		**CSO064_2 Perry Street Sanitary Sewer**	**980 days**	**Wed 9/1/32**	**Tue 6/3/36**		
369		**CSO017_1.1 SPP054 Sewer Separation**	**980 days**	**Wed 9/1/32**	**Tue 6/3/36**		
377		**CSO055_1.1 Hertel at Delaware ILS/Hertel North East**	**1240 days**	**Thu 9/1/33**	**Wed 6/2/38**		
385		**CSO055_3 20% GI Implementation**	**1174 days**	**Thu 9/1/33**	**Tue 3/2/38**		



Project: BSA_LTCP_Rankingand
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Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	